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COOK COUNTY HOSPITAL

Department of Surgery

ECTOPIA TESTIS TRANSVERSA

CROSSED ECTOPIA OF THE RIGHT TESTICLE, WITH DESCENT OF BOTH THROUGH LEFT INGUINAL CANAL INTO LEFT SIDE OF SCROTUM

BY ALBERT E. HALSTEAD, M. D., CHICAGO

Professor of Clinical Surgery, Northwestern University Medical School; Professor of Surgery, Post-Graduate Medical School; Attending Surgeon, St. Luke's and Cook County Hospitals

REPORT. D. C. B., American, single, aged 42, entered the Cook County Hospital, January, 1904.

History. Patient has had a left inguinal hernia of large size since early childhood. Of late this hernia has increased in size until now the tumor measures eight inches from the pubic spine to the lower limits of the scrotum. Two months ago the hernia, which previously was readily reducible, became irreducible and painful. In addition to the hernia, he has for several years been suffering from severe hemorrhoidal disease. His object in entering the hospital was to secure by operative treatment relief from both diseases.

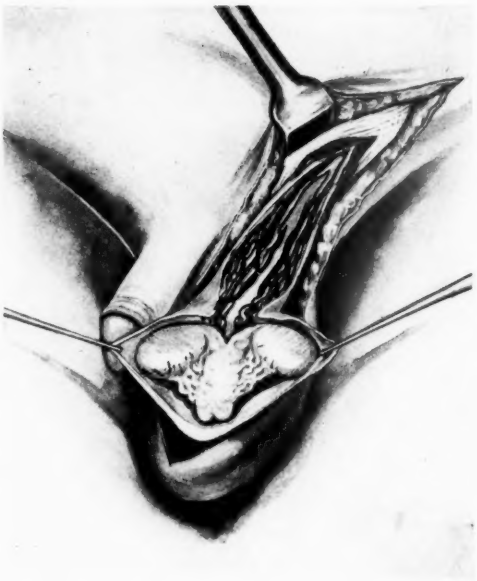
Examination. On entrance, examination shows a well-developed, middle-aged man. Nothing worthy of note was found, excepting a large left inguinal hernia, distending the scrotum to the size of a child's head. Rectal examination disclosed the presence of a large mass of ulcerated hemorrhoids protruding from the anus.

Operation. In clinic, January 7, 1904; assisted by Dr. R. H. Rea, house surgeon.

After the usual preparation, an incision 3½ inches long was made over the hernia, exposing the sac. The sac was opened and the adherent loops of small intestine, constituting the contents of the hernial sac, were, after being freed, returned to the abdominal cavity. In separating the sac, it was noted that the spermatic cord was of unusual size. While freeing the sac from the cord, the remaining contents of the left side of the scrotum were brought into the incision. This was found to be a structure that on superficial examination closely resembled a uterus with the tubes and ovaries attached. On closer inspection it was found that the central body, representing the uterus, consisted of a fusion of the epididymis of the two testicles. The testicles were not closely adherent to the heads of the fused epididymis, but swung free from the attached lower half of each, with the entire mass dislocated forwards into the operative wound, the heads of the epididymi, fused, occupied a portion behind and somewhat below the testicles. The testicles were inclosed in a common tunica vaginalis. The vasa deferentia could be traced separately from the globus minor upwards behind the fused epididymi to a short distance above the globus major, when they approached each other, and apparently became fused into one cord close to the internal ring. There were two spermatic arteries and two sets of veins; these were of large size, and, with the large vasa deferentia and an unusual amount of fatty tissue, greatly increased the size of the cord. The testicles were small, and in size were decidedly out of proportion to the large mass representing the fused epididymi.

Examination showed the right side of the scrotum empty. The right external ring was closed.

Recapitulation. The findings of this case were as follows: Both testicles were found to occupy the left scrotal pouch — both having a common tunica vaginalis. The testicles were of equal size, small, but normal in consistency. The epididymi were fused from the middle third downward to the globus minor. They evidently contained, in addition to their usual structure, a large amount of fibrous tissue and fat, which, with their relatively large size, formed



Ectopia testis transversa.

a mass that closely resembled a uterus. From the upper part of this mass on each side, anterior to it, were suspended the relatively small testicles. Between the upper part of each epididymis and the testicle was a band of connective tissue and serosa (fused posterior portion of the tunica vaginalis), which resembled the broad ligament of the female. The rather free upper portion of the epididymis, crossing above this fold, resembled a Fallopian tube. The vasa deferentia were distinct and of large size until the upper part of the inguinal canal was reached; here they were closely bound together, forming one large-sized cord. The entire spermatic cord was of unusual size, being fully 1¼ inches in diameter at the point where it passed into the internal ring. As there was nothing in this condition which justified the removal of these testicles, they were replaced in the scrotal pouch and the hernia operation completed without transplanting the cord. The large size of the cord made closure of the hernial opening difficult. The hemorrhoids were removed by the clamp and cautery method. Recovery from both operations was complete and satisfactory.

The cause of this abnormal condition is to be found in anomalies of growth which occur in early fœtal life in the genital area. This leads to joining of the Wolffian tracts of the two sides in their lower portions; that is, in the line of the sinus urogenitalis, while the portion toward the testicles remains free. Therefore there occurred these changes in the Wolffian tract which normally occur in the Müllerian tract, and which lead to the formation of the uterus, and it would appear that the Müllerian ducts at this early date, which are now well developed, may have a part in this malformation. These changes undoubtedly antedate the beginning of the descent of the testicles. Crossed ectopia or transposition of the right testicle resulted from the left possessing greater energy, thus dragging the right testicle through the left inguinal canal into the left scrotal pouch. The presence of a single tunica vaginalis is easily explained.

After a careful search of the literature, two similar cases were found, the first reported by the anatomist, Lenhossek, in 1845, in the *Anatomischer Anzeiger*. This was a specimen found in the body of a man of 35, who had died of typhus fever. His description of the specimen is as follows:

"Both testicles are found in the left half of the scrotum, and, moreover, the left testicle at the bottom of this, is in normal location. The right, on the contrary, is ectopic, 2½ cm. higher than the former, and at the same time somewhat anterior and more toward the median line. Both are of normal size and of normal structure. Both show no trace of disease changes, and are everywhere covered with smooth, shiny serosa. Their mutual arrangement is such that they are in intimate contact with each other throughout their extent. As far as their relations can be made out from the specimen, the position of their axis does not differ from that which the left testicle ordinarily has, since their upper poles point forwards and laterally, their lower poles posteriorly, and toward the median line. There is, therefore, an inversio testis present only, and as regards this one, only in so far as this corresponding with its abnormal position imitates the direction of the left testicle. Finally, it must be remarked that reduplication of the vaginalis propria which covers the structures passing to the testicle, and attaches it along the

epididymis to the scrotum, is somewhat shorter and more tense on the right testicle than on the left. The vasa deferentia become associated a few centimeters from their origin, and are from this point on throughout their entire course held together by loose connective tissue. They lie so closely to each other that one might think that they were one cord. Both pass through the left inguinal canal, pass down into the pelvic cavity and along the base of the bladder until close to the upper border of the prostate. Only here do they begin to separate, the left vas deferens uniting immediately with the lower end of the normally developed seminal vesicles, while the right, after making a right-angle turn, passes for a few millimeters in a transverse direction, thereupon to be also joined to the normal right vesiculæ seminalis. Aside from this abnormality, the internal and external sexual organs had a normal formation."

Jordan reported a second case (*Deutsch. med. Woch.*, 1895, xxi, 525). His description of the case is as follows:

"A boy, eight years old, brought for operation on the 14th of April, 1893, for removal of a congenital left-sided inguinal hernia. An examination of the well-nourished boy showed, besides a rupture, an unnoticed hypospadia of the third degree, with a rather wide urethral opening at the base of the scrotum. The right half of the scrotum is unusually small; even with the most careful palpation, no testicle can be found. The left half of the scrotum is swollen to the size of a goose-egg. There is a mass passing into it from the inguinal canal, which is tympanitic, which is easily replaced into the abdominal cavity. After replacement, one finds a wide hernial opening, which gives passage to two fingers. The left testicle seems enlarged. Under chloroform anæsthesia the sac was laid bare, and the latter opened after replacing the intestine. It was then found that an open processus vaginalis was present, at the bottom of which were found two rounded testicle-like bodies, from which two cords placed subperitoneally passed toward the inguinal canal. Since the anatomical conditions were uncertain, I did not extirpate the sac, closed the neck of the sac with a purse-string suture of catgut, and closed the incised sac with a running catgut suture. The course was without fever, and healing with a linear scar. At the beginning of June (in the mean time the first and second acts of the Thiersch's hypospadias operation had been done) there was noticed a recurrence of the left-sided hernia, and at the end of June the rupture had regained its original size. Second operation, June 28, 1893. After opening up the old scar the neck of the sac was again opened and the intestinal coil replaced. The same conditions were found as at the first operation, only the two bodies which were the testicles were adherent to each other by fibrin layers and showed hemorrhagic discoloration. The separation of the adhesions and the isolation of the two cords passing up to the inguinal canal was easily accomplished. In order to close the peritoneum, the serosa at the posterior circumference of the neck of the sac was cut transversely and separated for a certain distance from the underlying parts. Then the neck of the sac was closed with a suture of catgut and inverted by a few interrupted sutures. Since an adequate closure of the very wide hernial opening seemed impossible by reason of the peculiar anatomical relations, and since, on the other hand, the configuration, consistence, and location of the testicles excluded with considerable certainty any functional activity, the entire contents of the scrotum were extirpated. At the hernial opening, the cord, etc., were cut transversely, the separate vessel isolated and ligated. At the cut surface a greatly thickened and widened vas deferens presented itself. The ligated neck of the sac slipped back into the abdominal cavity. After freshening of the pillars of the hernial opening, it was closed by several wire sutures and several superficial catgut sutures. Healing without any difficulty, with a firm scar.

"*Anatomical Examination.* The extirpated sac had a diameter of from three to four centimeters, and showed a scar-like thickening of its wall. From it are depending two plexuses, about four centimeters long, and having the thickness of a finger. The essential point of the abnormality can be studied from the condition of the vas deferens. There is one single vas deferens common to the two testicles. This can be seen on the cut surface without any difficulty as a thick-walled tube, the dimensions of which are not in proportion to the youthful age of the boy. This thick vas deferens descends transversely downward toward the left, and is surrounded in its course by firm tissue, in which there are numerous fine bands (largely blood-vessels). The mucous membrane is smooth, and has the characteristic folds. The thickness of the wall increases gradually toward the lower part. The lumen increases, and forms, not far from the point from which the above-mentioned finger-like plexuses diverge, a sort of ampulla, which is well developed, especially in the transverse diameter. By means of this the separation of the common canal into two vasa deferentia is prepared. The right vas deferens turns off at a sharp angle from the common duct, and shows in its further course a normal size and normal condition. At first straight, then slightly convoluted, it passes down to the epididymis, which latter fills out almost all of the terminal portion of the right process. This process represents the right bursa inguinalis (that is, the covering of the scrotum with the exception of the skin). A red fibrous covering is also present, a Cooper's fascia. With it, all the deeper tissues are so mingled that neither the cremaster nor the tunica vaginalis communis can be made out with certainty. The testicle is well preserved, and appears as an oval body of normal size, with regard to the age of the patient, at the anterior part of which the peritoneal lumen is still to be seen. Laterally from the testicle, one may see the median free border of the epididymis. Between both there is a very thick bursa testis. The

epididymis is enormously enlarged, and shows only at a few places the normal canals of the epididymis on section. Besides this connective tissue, parts are enormously increased, so that it shows, on the whole, considerable fibrous thickening. The left vas deferens is well preserved. It forms at first a direct continuation of the common portion, and has likewise a very wide lumen and firm wall. About one centimeter from the point where the right vas deferens passes off, the left vas deferens takes on a normal thickness and passes with slight undulations somewhat backward and to the outer border of the left bursa inguinalis. This latter now shows a large mass of fat in place of the epididymis. The testicle itself cannot be found. The end of the left vas deferens can be followed down into the above-named mass of fat. Microscopic examination shows adipose tissue, among which a few epididymis canals are scattered. From the left vas deferens venous spermatica interna passes upward, which by its plexiform formation reminds one of the plexus pampiniformis. Nothing can be made out on the left side of the cremaster, etc."

COOK COUNTY HOSPITAL

Department of Surgery

THE TREATMENT OF HIP DISEASE

With Special Reference to the Correction of Late Deformities by a New Procedure

By JOHN L. PORTER, M. D., Chicago

Attending Orthopædic Surgeon to Cook County Hospital and St. Luke's Hospital; Professor of Orthopædic Surgery, College of Physicians and Surgeons, University of Illinois, etc.

Of all the various diseases and deformities of the hip appearing in the orthopædic service at Cook County Hospital, none is of more importance or of more perennial interest than tuberculosis of the hip, commonly called hip disease. Occurring as it does both in childhood and adult life, and frequently extending with various phases from one period to the other, and with its prognosis influenced by many conditions and complications, each case demands individual study and treatment.

It is not the intention here to go into details of the treatment of acute or early cases, with a description of the various mechanical devices used to secure fixation of the joint and to correct the early deformities due to muscular contractures.

The fact that the disease, especially in children, tends to spontaneous recovery when properly treated, and that the one thing essential to speedy recovery is absolute and prolonged rest of the joint, is being more generally recognized every year.

Not every surgeon realizes, however, that rest means not only relief from motion, but also from pressure and friction. A hip-joint that is simply immobilized and allowed to go on bearing the weight of the patient at every step is not at rest; and the more complete and continuous the treatment, the more easily and speedily will nature take care of the disease. Beyond this, a few general principles must be observed to secure the best results, and they may be briefly formulated as follows:

1. Pain and muscular spasm are most quickly relieved by traction. The result of traction depends not so much upon the amount as upon its continuity. Three pounds for a child up to eight pounds for an adult is usually sufficient.

2. When flexion deformity is present, as shown by the inability of the patient to lay the leg flat on the bed without arching the lumbar spine, the traction must be applied with the leg elevated to the angle of deformity until muscular contraction is abolished, and then gradually lowered.

3. When all pain and muscular contraction have disappeared, the joint should be immobilized, with the leg in an abducted position, as this gives the most useful position in the event of recovery with ankylosis at the joint. Abduction of 25° to 30° is sufficient, and most comfortable to the patient.

4. Any device which aims to secure immobilization at the hip must extend from the toes to the tenth dorsal vertebra, as rotation at the ankle or movement of the lumbar spine imparts motion to the hip-joint.

Every surgeon has his own preference as to the best apparatus or other devices with which to carry out the measures indicated, and each can secure the best results with the devices with which he is most familiar. (Fig. 1.)

Fig. 1. Showing method of making leg-traction in angle of deformity.

In the experience of the writer, the best means of applying traction for relief of pain and spasm is with a weight and pulley attached to the leg by long adhesives snugly bandaged on, and the most efficient means of immobilization is the long plaster-of-Paris spica, put on smoothly and lightly, but firmly. Such a cast may be worn for from three to six months, with the patient about on crutches, with no detriment whatever, and with the greatest benefit to the joint.

The most important complication arising in the course of the disease is the development of abscess, and there is no question in the entire subject of tuberculous joint disease about which there has been so much discussion and difference of opinion as the treatment of cold abscess. Between the ultraconservative orthopædist, who always waits for an abscess to rupture or disappear by absorption, and the general surgeon, who always incises and drains them as soon as they appear, there is a wide difference of opinion. But we have learned that true conservatism lies in neither of these extremes, and for him who considers the welfare of the patient as of first importance, and who reasons from an aseptic standpoint, there are very distinct indications as to what to do and when to do it. Recognizing that a tuberculous abscess is simply a collection of tuberculous *débris* and serous exudate — in other words, not an abscess at all, as we commonly use that term — and that many of them undergo spontaneous absorption and disappear without affecting the patient's general health in the least, and convinced that in every case where a cold abscess is allowed to rupture or is opened and drained, it soon becomes secondarily infected, the writer has formulated the following plan of treatment for abscesses appearing in a case of hip disease:

If the abscess is small, is not secondarily infected with pyogenic bacteria, and does not interfere with treatment, leave it alone.

If it shows a tendency to burrow extensively, and thus involve large areas of subcutaneous tissue; if its location is such as to interfere with efficient treatment; if the patient's general condition is poor, and he shows signs of chronic toxæmia, with irregular temperature, anorexia, etc.; or if the abscess has begun to point and threatens rupture — then incise through healthy tissue, evacuate it with gentle irrigation, and close up tight without drainage.

Treat it the same as we would any other aseptic fluid collection — a cyst, for instance.

It may refill — probably two thirds of them do — but it is better for the patient to undergo such a simple operation, which may be done with local anæsthetic, a dozen times, than to have the cavity become a culture-oven for pyogenic bacteria and ooze pus for months or years, as they always do.

If the abscess shows signs of secondary infection — pain, temperature, increased tension, etc. — open and drain, the same as any other true abscess.

We come now to a group of cases which, from the fact that the active tuberculous process is cured or has become quiescent, and only the deformity remains, require operative treatment. These are the late cases, which, having had no treatment or inefficient treatment, are limping about with the thigh flexed and adducted, and with the leg from 1½ to 4 inches shorter than the other. (Figs. 2, 4.) These cases offer problems of considerable mechanical and surgical interest, and the writer believes that a new

Fig. 2.

Fig. 3.

Fig. 2. Showing common flexion and adduction deformity, with 1½-inch actual shortening, but 3 inches functional shortening, from hip disease.

Fig. 3. Same case as Fig 2, one week after operation. Showing short spica, which is used when patient is able to be about.

method of correcting these deformities has been found, which offers the best mechanical results with the least mutilation and danger. (Fig. 6.)

Heretofore, the accepted, almost universal, method of treatment has been osteotomy of the femur, either intertrochanteric or subtrochanteric, with abduction and fixation. This proceeding was the result of the generally accepted idea that bony ankylosis has occurred between the upper end of the femur and the ilium.

Through the examination of a series of these cases, combined with a careful study of good skiagrams, the writer has become convinced that in the majority of cases the fixation of the joint is by fibrous tissue, and that bony ankylosis is rare, and found only many years after all disease has completely disappeared. In the majority of cases under thirty years of age, and in some older, by carefully fixing the pelvis, some motion between the upper end of the femur and its point of attachment to the ilium may be demonstrated. Even the slightest motion proves that fibrous, not bony, ankylosis exists, and the skiagram in nearly every instance confirms that deduction, and also shows it in many instances when no motion can be demonstrated.

The excellent results secured in other joints by forcible correction (the *redressement forcé* of French and German writers), where the joint is fixed in position of deformity by adhesions and adaptive shortening of tendons and muscles, suggested the possibility of the same procedure here. In fact, it seemed possible that better position of the leg with less shortening might be secured by this maneuver than by osteotomy, especially if tenotomy of the adductor tendons was done at the same time to permit of freer abduction. In almost all of these cases the adduction deformity is an important factor, as it functionally increases the actual shortening which may exist, while, *per contra*, if the shortened leg can be carried into an adbucted position without increasing the actual shortening, the leg becomes functionally longer and the disability much lessened. Other advantages are, that the operation is much less formidable to the patient than a bone-cutting operation, and the patient is confined to bed for a shorter time. The chief obstacle to the success of the operation is the difficulty in applying sufficient power with the hands alone to secure the neces-

Fig. 4.

Fig. 5.

Fig. 4. Showing extreme flexion and adduction deformity, with luxation upward and backward of femur, and 5½ inches shortening.

Fig. 5. Same case as Fig. 4. After operation. Showing actual lengthening of leg and abduction.

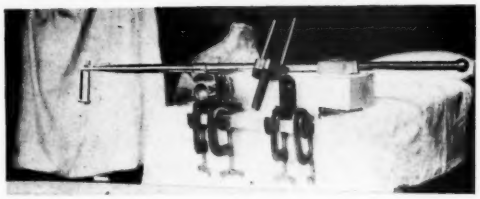


Fig. 6. Showing apparatus.

sary traction and abduction. The writer has operated upon several cases of severe deformity at the hip, using an apparatus originally designed by Ridlon, and suggested by Bartlett's machine, for making traction and abduction in cases of congenital dislocation of the hip. This apparatus has undergone various modifications by both Ridlon and the writer, until the one illustrated here has been evolved, but the principle of the original apparatus is still preserved. (Fig. 6.)

The machine consists of a strong, heavy resistance-plate, *a*, clamped to the table, having on one side a smooth elliptical metal plate for contact with the perineum, and on the other an upright flange for receiving the movable socket or fulcrum, *b*. Another strong plate bearing a similar upright flange for the socket, *c*. A jointed lever of one-inch gas-pipe, three feet long, fitted with a spherical knob at the proximal end, to bear in the socket on *a* and *b*, and on the other end a windlass with ratchet-

Fig. 7. Showing position of apparatus and patient at time of doing the tenotomies.

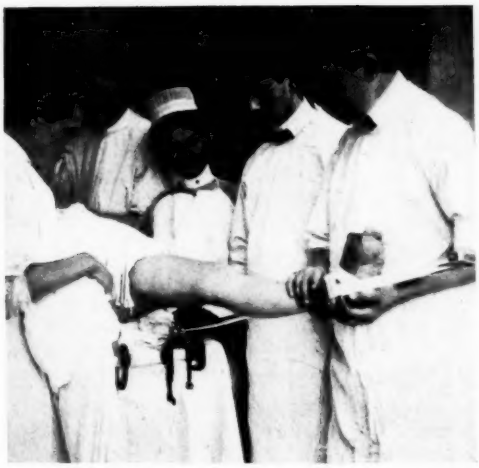


Fig. 8. Showing position of patient and apparatus at completion of operation, ready for the plaster spica.

screw, set at right angles to the long axis of the lever. This is made in jointed sections, so that when used for a child it can be made two feet long instead of three, as when used for an adult, *d*. A hemispherical socket with slotted plate on the flat surface, which can be slipped onto either *a* or *b* and fastened at the desired height by set-screws, *e*. A solid, heavy triangular steel block 4 x $3\frac{1}{2}$ x $\frac{3}{4}$, with half-inch holes bored into its upper surface to receive two five-inch steel pins; its lower surface welded onto a $\frac{1}{2}$ x $\frac{3}{4}$ x 4-inch upright, which fits into a slot in *a*. This is to replace *a* as a perineal resistance when the operation is complete, and the patient is lifted up onto *f*, a flat smooth triangular sacral plate with a half-inch stem affixed to one angle, which also fits into a slot in *a* and supports the pelvis while the plaster-of-Paris is being put on. These last two attachments, *e* and *f*, permit the operator to keep up the traction and abduction and maintain the corrected position of the leg while the spica is being applied. The patient, full anæsthetized, is brought down to the edge of the table, with the perineum against the saddle, the pelvis resting on a folded sheet. The ankle, protected with felt and a leather anklet, is fastened to the windlass at the distal end of the lever by a rawhide strap. If there is much adduction deformity, the proximal end of the lever is set in

the socket on the perineal saddle, and traction is made by the windlass until the adductor muscles are tense. Then the tendon of the adductor longus is divided along with the fascia lata at the pubes, and if the tendon of the adductor magnus at the internal femoral condyle is prominent, it is also divided. (Fig. 7.) The wounds need not be over half an inch to an inch in length, and are immediately closed by a suture and collodion dressing. The fulcrum is then removed to the upright, *b*, on the outside of the leg, and, tightening the windlass, adduction and extension are gradually begun by carrying the lever outward and downward while the pelvis is held firmly fixed by firmly flexing the well leg on the abdomen. The amount of power that can be exerted by the combined traction and abduction of the lever is enormous, and must be carefully and gradually applied. We have estimated that from five hundred to eight hundred pounds have been applied to some of our cases. A distinct crepitus is felt at the hip as the adhesions are broken up, and the adductor muscles can be seen to stretch as they give way at the pelvis. When the leg has been abducted to 25° or 30° and the flexion abolished, the patient is lifted onto the pelvic rest and a plaster-of-Paris spica is put on, with the power still maintained by the lever, while the resistance is maintained by the perineal uprights. (Fig. 8.) The most astonishing fact about the whole thing is that the patient never complains of any discomfort in either knee or ankle afterward, in spite of the enormous pull that is put upon both, and we have never seen any sign of hæmatoma or subcutaneous extravasation, notwithstanding the stretching that occurs in the muscles, and most of the patients are up and about inside of a week, with perfect comfort. (Fig. 4.) Theoretically, the objection may be raised that this procedure is liable to light up a quiescent tuberculosis still present about the joint, and subject the patient to further mechanical treatment and disability from the tuberculous disease. The best answer to that is the fact that in a series of about fifteen cases operated upon by the writer and Ridlon, with this apparatus, such a result has never occurred. As a matter of fact, if it did happen, it would be no argument against the procedure, as it puts the leg into the best possible position for ultimate recovery, and, although prolonging the period of treatment, gives the patient a more useful leg.

COOK COUNTY HOSPITAL

Department of Surgery

PERFORATION OF GASTRIC ULCER

A Report of Two Cases, with Recovery

By WILLIAM HESSERT, M. D., Chicago

Professor of Surgery, Chicago Policlinic; Surgeon to Alexian Brothers Hospital and Cook County Hospital; Interne, Cook County Hospital, 1892–93

THE perforation of a gastric ulcer is one of the most serious accidents which can occur in the abdomen, and, analogous to gunshot wound or subcutaneous rupture of a hollow organ, the whole matter is conceded to depend upon early diagnosis and early operation. The literature on perforation has already become very large. In the *Centralblatt für die Grenzgebiete der Medizin und Chirurgie*, Nos. 1–5, 1906, Goldstücker publishes a complete bibliography from 1897 to October 1, 1905.

Case 1. Female, single, aged 19 years; enjoyed good health up to the age of 7 years; from that time until 14 she was in delicate health. At 14 she began to have stomach symptoms; namely, pain in the region of the stomach, with vomiting, sometimes before meals, sometimes after; vomited blood at times. Her symptoms occurred periodically, with remissions, during which she felt fairly well and regained some strength.

In June, 1903, she had a severe attack, characterized by sudden onset of severe pain in the left lower portion of the abdomen. She fainted and went into collapse; vomited. After some hours, the pain subsided somewhat, but persisted for three days. Associated with this was a great distention of the abdomen; she was very sick for ten days, and was confined to bed for five weeks. After recovering from this attack, the periodical pain and vomiting reappeared and the general health was poor. This history would lead one to suspect that she had had a perforation from which she recovered spontaneously.

July 5, 1905, at noon, she was seized with pains in the left lower quadrant of the abdomen. She had not eaten anything for five hours. Dr. D. E. Murphy saw her soon after, and found her in severe shock from pain; small, rapid pulse; cold extremities; costal breathing; no vomiting. Abdomen retracted and board-like. Left side of abdomen very tender, and left rectus especially tense. The writer saw her at eight o'clock in consultation. She had had morphine and was reacting; pulse small and rapid; temperature 99°. There was no vomiting and the pain had lessened. Abdomen was still rigid and tender, especially in left lower quadrant. A diagnosis of gastric ulcer, with probable perforation, was made. One feature of the history, however, made us delay operation; namely, the fact that two years ago she had a very similar attack, which subsided of itself. This is why we watched her for a while. In the light of further developments, I question the wisdom of this course.

The stomach was already, fortunately, empty, and she was fed per rectum, everything being withheld by mouth. She reacted nicely, the pain subsided largely, and the patient felt very comfortable, although no further morphine was given. She felt so well that we were inclined to doubt the diagnosis. However, after two days the pain recurred, and the abdomen began to be slightly distended. Pulse rose to 114, and temperature to 101°. Operation was performed fifty hours after the first onset of symptoms.

Operation. A three-inch incision was made to left of median line, beginning at costal border. On opening the peritoneal cavity, a small quantity of turbid, odorless fluid escaped. On pulling out the stomach, a perforation was readily apparent on the anterior surface, near the lesser curvature in the cardiac region. The opening was as though punched out, and one centimeter in diameter. Surrounding was a zone of three centimeters, which appeared red and indurated, and was covered by plastic lymph. There were no adhesions, and but little escape of stomach contents; there was a beginning peritonitis in the subphrenic space, and some turbid fluid was swabbed out here, but the peritoneum below seemed as yet little involved.

The perforation was first closed by through-and-through sutures of silk; some difficulty being encountered on account of tearing through. Over this a row of Lemberts in firm, healthy tissue closed the opening securely. No other perforations were found, nor were any old scars apparent. The region was thoroughly swabbed out, but not irrigated, and drained with two cigarette drains.

Post-operative History. Patient rallied from operation well, and made an uninterrupted recovery. Nutritive enemas for ten days, when she was first given liquid food by mouth. Bowels moved regularly, and she vomited but a few times. The wound was entirely closed at the end of three weeks, at which time the patient was taking quite an amount of solid food, which was well borne.

In November, 1905, the patient was presented before the Chicago Surgical Society. She had gained about thirty pounds in weight, and weighed more than she had

ever weighed before. It is now sixteen months since the operation, and her health continues good, and there has not been a return of gastric symptoms. I refrained from doing a gastro-enterostomy, fearing that the additional time required would lessen the chances of recovering from what was already a desperate condition, and I have not as yet had reason to regret my decision at that time. Undoubtedly, the emptiness of the stomach at the time of perforation, and the judicious care before operation, were the reasons for the slight spread of peritonitis during the period of fifty hours following perforation.

CASE 2. Female, aged 61 years. Admitted to the medical service of the Cook County Hospital in December, 1904, and transferred to my service in January, 1905, with a diagnosis of carcinoma of the stomach.

History. Fifteen years previously she had received a violent blow in the epigastric region, from the effects of which she claims she suffered a long time. She dates the beginning of her gastric symptoms from this time. She had all kinds of dyspeptic symptoms; viz., weight and fullness after eating, flatulence, eructations, etc. For the last number of years she has vomited frequently after meals, and had pain in the region of the stomach. She also vomited blood at frequent intervals, and began to lose steadily in weight. She had periods of severe pain and vomiting of blood. All food finally distressed her, and she was in a very miserable condition.

Examination. Considerable general emaciation; cachectic appearance. Chest negative. Abdominal walls thin and lax; upper abdomen slightly protuberant. In the epigastric region, in the median line, and extending over to the left side, could be distinctly felt a hard mass. It was not particularly tender, and very slightly movable. It was the size of a small fist, and was not very sharply outlined. The diagnosis of carcinoma was concurred in, and an exploration was consented to.

Operation. January, 1905. On opening the abdomen, a large mass was discovered, involving the lesser curvature of the stomach, in the cardiac region, and extending more to the posterior than to the anterior surface. The colon and omentum were drawn up and adherent, and there were general adhesions all around and to the liver. The mass was adherent posteriorly, so that the stomach could not be brought up for closer examination. The tumor involved the stomach-wall, which was thickened, but there appeared to be considerable inflammatory exudate. While separating some of the adhesions, I inadvertently opened a small cavity, which contained stomach contents, and communicated by a large opening with the lumen of the stomach. I supposed at the time that I had perforated a weak spot in a cancerous stomach, and stitched it up again. Along the lesser curvature there were some enlarged lymph-glands. The patient's condition not being very good, I closed the abdomen without doing anything further, believing the case to be an inoperable carcinoma.

The patient recovered from the immediate effects of the operation. She continued to have gastric symptons — pain, inability to eat solid food; sometimes all food distressed her. She vomited frequently, but never blood. While her condition was very distressing, she did not get any weaker; rather gained, if anything. The mass in the abdomen was observed to be getting smaller, so that after about four months it was no longer palpable. She was also much better in every respect than she was before. However, she consented to another operation, and May 15, 1905, I opened the abdomen again. The mass was entirely gone; there were some adhesions to the surrounding organs and to the abdominal wall. The stomach was no longer thickened, but a distinct cicatrix was visible at the pyloric end of the lesser curvature, somewhat to the posterior surface, where I had sutured the perforation. The glands likewise were markedly decreased in size. This cleared up the situation entirely. This patient had had an ulcer for many years, when it finally perforated, chronically, so that there was time for adhesions to form between the opening and the liver. I believe it perforated more into the lesser peritoneal cavity, with the formation of a large amount of exudate and general thickening. Such was the condition at the time of operation, when I discovered and sutured the opening that I thought was accidental. This had a curative effect, however, because the condition was found to have cleared up. I am not sure about the presence of the old ulcer at this time. There was a scar and some thickening, but the stomach was not dilated nor distorted in its contour, nor was there any stenosis. I closed her up again, believing she would go on to complete recovery. In this I was greatly mistaken, and had cause to regret that I did not perform a gastro-enterostomy while I had the chance. While she improved for a while, she became worse again.

She had pain, vomited frequently, could not take solid food, but did not vomit blood. Finally, after standing this condition for six months, without, however, becoming as emaciated as she was at first, she consented to a third operation, which was done November 27, 1905. I found conditions locally about as they were at the last exploration. A typical posterior gastro-enterostomy was made, bringing up the jejunum so as to avoid loop formation.

The patient made an uneventful recovery from this operation; her stomach symptoms did not reappear, and at the present writing, a year has passed, and she is in better health than she has been for fifteen years. There has been a considerable gain in weight, she can eat anything, and does not know that she has a stomach.

This history illustrates how a chronic perforation may simulate a carcinoma, and lead one to make an absolutely unfavorable diagnosis. One must always consider such an event in dealing with tumors of the stomach. It further demonstrates the positive unmistakable benefits which such patients may derive from a gastro-enterostomy.

Perforation may be: 1. Acute; 2. Subacute; or 3. Chronic.

Acute perforation usually occurs on the anterior wall of the stomach, and is followed by a rapidly spreading peritonitis.

Subacute perforation is found on the anterior wall or elsewhere. The spread of infection is less rapid, due either to the small size of the opening, emptiness of the stomach, partial adhesion to a neighboring organ, or to the omentum.

Chronic perforation usually has its seat on the posterior wall. Before actual perforation, the site of the ulcer has been walled off by adhesions to surrounding organs; a perigastritis with exudate has formed, and when the stomach-wall perforates, a local abscess results. This spreads in the direction of least resistance into the subphrenic space, lesser peritoneal cavity, or in a downward direction. It may finally rupture into the free peritoneal cavity.

Sex. The relation of males to females in the matter of perforation is about 1 to 3.

1 to 3.6, Moynihan.	1 to 2.3, Moullin.
1 to 2.5, Brunner.	1 to 2.4, Haim.

Age. The following statistics show the afflicted males to be older than the females, viz.:

Males	Females	
37.3 years.	24.4 years.	Moynihan.
35 years.	23 years.	Brunner.
45 years.	23 years.	Lennander.

Cheyne reports a perforation in a girl of 13, and Bisset, in an infant of 45 hours. Cases in old people are interesting from the fact that the perforation is liable to be a chronic one with exudate, which, forming a palpable tumor, may be mistaken for a carcinoma. Musser and Keen report one at the age of 70 years; Riedel reports one at 60 years, Myles at 72 years, and case 2 of this report at 61 years.

Previous History

	Previous Gastric Symptoms	None
Moynihan	40 cases.	5 cases.
Goldstücker	84 cases.	12 cases.
English	37 cases.	5 cases.
Haim	67 cases.	7 cases.

The above tabulation shows that in the majority of cases a previous history of some gastric disturbance, such as dyspepsia, pain, vomiting, etc., can be obtained.

Symptoms of Perforation. Can an impending perforation be diagnosed? Leube voices the opinion of the majority, when he declares that a threatened perforation cannot be recognized nor foretold. The symptoms of subacute or chronic perforation may be so indefinite and progress so slowly, that it may be impossible to state the exact time of rupture. There will be the gastric symptoms, plus those of a chronic local peritonitis. The signs of an acute perforation, however, are usually so decided and classic as to make a diagnosis not difficult, provided the case is seen early enough.

Pain. Of all the symptoms, this stands foremost in importance and constancy. The initial pain usually sets in suddenly, with great intensity, and in the majority of cases is referred directly to the place of perforation. It may, however, be referred to the region of the shoulder-blades, or to the lower abdomen, especially to the left side. As peritonitis sets in, the pain ceases to be localized, finally becoming general.

Tenderness and Reflex Muscular Rigidity. Over the seat of perforation, in the epigastric region, either to the right or left, tenderness is constantly present. It varies in intensity, and may be extreme. Associated with it, and elicited by the same touch, is that very important and characteristic phenomenon — reflex rigidity. Reflex muscular rigidity is not pathognomonic of gastric perforation, as it occurs with perforation of any hollow organ, as well as anything that may cause a local peritoneal irritation or peritonitis, such as hemorrhage, escape of fluid or pus, appendicitis, and the like. However, whatever may be the cause of the "acute abdomen," in its early stages the muscular rigidity is likely to be over the point of lesion. So in gastric perforation, the rigidity first affects the upper portion of the rectus muscle, and possibly only the right or the left. Soon, however, with the progress of peritonitis, the rigidity becomes general, and the whole abdomen may be retracted and board-like. In this stage of general rigidity and general pain, especially if there have been no previous gastric symptoms, a differentiation from duodenal ulcer or appendicitis may be almost impossible. One has but to recall how often the symptoms of appendicitis are referred to the gastric region.

This board-like, retracted abdomen is Nature's attempt to put at rest peristaltic action, and thus retard the spread of infection. For this reason, morphine, which relaxes muscular spasm,

should be withheld whenever possible, unless immediate operation follows. As the peritonitis becomes general, contracture gives way to distention and a degree of relaxation. If the patient is first seen in this late stage of general peritonitis with a negative previous history, the original lesion may be too obscure to be recognized.

Is it possible to diagnose the seat of perforation in the stomach? In early cases this is sometimes possible, as is borne out by a few recorded cases. The point of greatest tenderness being to the right or left of the median line may point to the pyloric or cardiac region respectively. A point of tenderness well to the right might be due to a perforation of the duodenum, and these factors would guide us in placing the incision.

Pulse and temperature are not characteristic. The former is usually accelerated, as in cases of shock or peritonitis. The latter may at first be normal or subnormal; later, with spread of infection, there is the usual rise.

Vomiting. This symptom is no particular aid to diagnosis. According to Brunner, vomiting occurs in about one third of the cases at the time of perforation. Vomiting is a common accompaniment of most acute abdominal involvements.

Shock. The amount of shock depends in a measure upon the amount of gastric contents which have escaped into the free abdominal cavity, as well as upon the amount of initial pain. If the stomach was empty and the pain not severe, there may be little or no shock. If a full stomach emptied itself into the peritoneal cavity, extreme prostration has been observed. It has been so severe as to be fatal soon after the perforation.

Auscultatory phenomena, such as the presence of a peritonitic friction rub in the epigastric region, or vocal fremitus in the upper abdomen, have been observed, and variously interpreted to mean perforation and free gas in the peritoneal cavity.

DIFFERENTIAL DIAGNOSIS

1. *Perforated Duodenal Ulcer.* It may be impossible to differentiate this from a gastric ulcer near the pylorus. Duodenal ulcers occur more frequently in men, and there is absent the distinct history of previous gastric trouble. The pain is usually at first more to the right, with rigidity of the right rectus muscle.

2. *Acute Perforative Appendicitis.* I have seen cases of acute appendicitis where the gastric symptoms were so prominent that I was tempted to incise over the stomach. Yet there will usually be found indications which point to the right iliac fossa, such as the previous history of attacks, the less sudden onset, the predominance of pain and tenderness, ordinarily in the right iliac fossa, with rigidity over this region. It must be remembered, in this connection, that a few cases of coincident perforation of the stomach and appendix have been recorded.

3. *Perforated Gall-bladder.* A perforated gall-bladder may resemble very closely either a perforated gastric or duodenal ulcer. A case of this kind came under my observation. An elderly woman, always previously healthy, was taken severely sick after over-lifting. There was severe pain in the upper abdomen, vomiting, with tenderness and rigidity in the epigastrium. Operation was urged, but refused. Only after several days, when peritonitis was well established, was operation allowed. There was a general peritonitis, a large perforation of the gall-bladder, and a gall-stone, the size of a small hen's egg, free in the peritoneal cavity. This large solitary stone was the only one present. The patient died.

Carcinoma of the Stomach. Only the chronic form of perforation could be mistaken for carcinoma. Clinically, they have some points in common, such as a previous history of gastric disturbance, pain, vomiting, emaciation, tumor, etc. Examination of stomach contents might not show anything positive. To render the history more confusing, a cancer might have been grafted on an old ulcer. According to my experience, even at operation it might be hard to decide between a cancer and old calloused perforated ulcer with a perigastric exudate. Especially so, if the mass is located posteriorly and surrounded by old adhesions. In ulcer the lymph-glands are not so numerous nor so hard as in cancer. Signs of peritonitis will probably predominate in ulcer. If a radical excision can be safely done, it is best in cases of doubt. In my second case, the mass was

taken for inoperable carcinoma, but in six months it had entirely disappeared.

Acute pancreatitis presents the picture of a desperate abdominal condition, with shock, vomiting, pain, tenderness, rigidity, etc., and I have seen this condition found where perforated gastric or duodenal ulcer had been diagnosed.

Colic due to gall-stones, renal calculi, or lead can usually be identified by a close observance of the history and a rigid examination. The same is true of the gastric crises of tabes, yet there are a few tabetics who carry the scar of a negative exploratory.

Pelvic diseases, such as ruptured extrauterine pregnancy, ruptured or leaking pyosalpinx, ruptured ovarian cyst, or torsion of its pedicle — all of these might be the cause of an "acute abdomen," but there should be no difficulty in locating the trouble in the pelvis. I saw a case of pyosalpinx recently which presented very acute sudden symptoms of severe abdominal pain, vomiting, chill, rigidity, and great tenderness. The trouble was referred more to the pelvis, and the vaginal vault was tender. At operation I found a recent pyosalpinx, the tube on one side being moderately enlarged, but its fimbriated end was patent, and thick, creamy pus was oozing into the free peritoneal cavity. There were no adhesions, and a slight amount of pus was swabbed out of the pelvis. The tube was ablated, the abdomen closed without drainage, and the patient recovered.

Site of Perforation. While the majority of gastric ulcers are found on the posterior wall of the stomach, yet perforations occur mostly anteriorly, as shown by the following:

Anterior wall : posterior wall :: 7 : 1.	Gross.
Anterior wall : posterior wall :: 4 : 1.	Weir and Foote.
Anterior wall : posterior wall :: 5.5 :: 1.	Haim.
Anterior wall : posterior wall :: 7 : 1.	Brunner.

According to Brunner and Gross, more perforations occur near the cardiac than in the pyloric region; the proportion being about five to three, respectively. The size of the opening ranges from a pin-point to that of a half-dollar.

Number of Perforations. That there may be more than one perforation should always be remembered. According to Moynihan, one fifth of the cases have multiple perforations. This teaches us to examine always the entire stomach carefully as well as the duodenum.

Treatment. W. J. Mayo says: "The surgical treatment of acute perforation of the stomach is now on a sound footing, the results depending on speedy diagnosis and prompt operative relief." In cases of "acute abdomen," where the diagnosis of a perforation is at all probable, immediate operation is indicated. While spontaneous recovery has occurred, one cannot depend upon such a remote possibility. Brunner has collected seventeen authentic cases which recovered without operation, owing to favorable circumstances as regards location and size of perforation and emptiness of the stomach.

It is wise in any doubtful case, while a diagnosis is being made, to discontinue all food and cathartics by mouth, and rely on rectal feeding. Morphine should be avoided, as before stated. I have known cases where the patient felt so well after the morphine that she refused to believe that she was critically ill, until the effects of the drug wore off and the pain recurred. In the mean time, consent to operate had been withheld, and valuable time was lost. I have experienced the same thing in appendicitis and other acute abdominal conditions.

Mayo further says: "Patients operated on within the first five hours usually recover; after ten hours, the majority die. We have had seven gastric with two deaths, and nine duodenal with three deaths. Suture of the perforation and pelvic drainage, with or without irrigation, the patient being subsequently maintained in the semi-sitting posture (exaggerated Fowler's) for several days gives the best results."

Moynihan had 52 per cent recoveries. Goldstücker studied 411 cases operated on, with 56 per cent recoveries. Where the operation was performed during the first twelve hours, 71 per cent got well. The mortality of late cases after two days is very high.

Should a Patient be Operated on during Shock? While it might be advisable at times to await some reaction, yet, as a general proposition, immediate operation should be the rule. A prompt operation, rapidly performed, with the least amount of traumatism and anæsthetic, will give the best results.

An ample median incision above the umbilicus exposes the field. The stomach is pulled into the wound and the perforation located as rapidly as possible, by examining, if necessary,

both surfaces of the stomach, and noticing the direction whence come stomach contents or gas. The opening, when found, is closed by a through-and-through Pagenstecher suture, being careful to insert the needle into firm tissue that will not tear out. In small perforations a purse-string suture will answer. Over this a row of Lembert sutures is applied. The line of suture should be placed at right angles to the long axis of the stomach, especially near the pylorus, to prevent stricture. If the stomach contained any food, it should now be washed out. As to the excision of the entire ulcer, this may be advisable at times; however, the bleeding and extra time consumed increase the danger.

Should a gastro-enterostomy be performed at this time, with a view of preventing such ultimate sequelæ as adhesions, stricture, persistence of ulcer symptoms, etc.? If one can be sure that such an additional step is not materially increasing the immediate danger, it should be done. However, as we are dealing with cases usually in a desperate condition, we should be content in striving to save the life of the patient, and not spoil all his chances by too much operating. If the patient lives, a gastro-enterostomy can be done later, if necessary, at a greatly reduced risk.

Inaccessibility of the perforation and friability of the surrounding tissues sometimes render suturing almost an impossibility, and tax the ingenuity of the surgeon to the utmost. Yet where sutures could not be inserted, tamponade yielded pretty fair results, considering the gravity of the situation. Whenever it can possibly be effected, the opening should be closed with suture, even if with only one row. To cover the line of suture by an omental graft is good practice, but to attempt to plug the opening by omentum, without suture, has not yielded good results. Before closing the abdomen, do not forget to examine the stomach and duodenum for a second perforation.

Whether or not to irrigate, and how to drain, depend on the degree of the existing peritonitis. In early cases, simply swabbing out and draining with a cigarette drain will answer. In late cases the matter of irrigating and draining must be left to the convictions of the individual operator. It is a subject too wide in its scope to be discussed here. Fowler's position should be maintained.

COOK COUNTY HOSPITAL

Department of Surgery

RUPTURE OF THE ABDOMINAL WALL

By CHARLES E. KAHLKE, B.S., M.D., Chicago

REPORTS of individual cases, if limited in number, amount to comparatively little in themselves, yet they may prove of value in the compilation of statistics. It is with this idea that I report the two following cases and present an abstract of the literature relative to the subject.

Case 1. Katie L., 4 years old, admitted July, 1903. Two hours before entering the hospital, this patient fell out of a third-story window, striking on the pavement. She was picked up and carried into the house. The attending physician, on removing the clothing, discovered several coils of bowel protruding from the abdomen. He covered them at once with sterile gauze and cotton, and sent her to the hospital — a two hours' trip.

I found this little patient comparatively free from shock, with approximately three feet of small bowel protruding through an opening in the upper right quadrant of the abdomen. The bowel was quite red from irritation from the clothing. The patient was anæsthetized, now three hours after the accident, and the prolapsed bowel covered with hot, moist boric acid compresses, while the surrounding area was thoroughly prepared in the usual way. The bowel was then irrigated with 1 to 2,000 bichloride solution, followed by normal salt solution. The wound was enlarged and the bowel returned. An iodoform-gauze drain was passed through the wound to the opposite side of the abdominal cavity. The wound was then closed in tiers in the usual way up to the drain. A small suprapubic incision was now made, and gauze and rubber-tube drainage inserted in the pelvis. The patient was placed in the Fowler position. Recovery uneventful. Drains removed on the fourth and sixth days.

The wound in this case was a transverse slit, two inches long, situated just to the right of the right rectus and two inches below the ribs. It involved the bellies of the external oblique and transversalis and the aponeurosis of the internal oblique. There was no hole or tear of any kind in the clothing to indicate that the wound was due to penetration by a foreign body of any description, nor was there anything in the surroundings where the patient fell that might cause a penetrating wound. I believe this to be an exceedingly rare case of complete rupture of the abdominal wall, entirely different in its mechanism from that of laceration due to machinery accidents.

In reviewing the literature on injuries of the abdominal wall, I find such cases as this one very rare. There are numerous instances of rupture of one or more of the abdominal muscles, but they are practically all subcutaneous.

Steinthal (43) says: "In injuries of the abdomen, as in inflammations, the abdominal wall plays a secondary part. The force usually expends itself on the abdominal organs, rather than on the wall." The same author says: "While a penetrating wound of the abdomen can hardly be produced by a blow if the abdominal wall is normal, instances have occurred in which the thin wall of a hernia has ruptured as a result of a fall and exposed the abdominal organs." In this particular case there was nothing in the past history that might make one suspect any pathology in the muscles.

P. J. Higgins (44) described a case of rupture of the abdominal walls; protrusion of the stomach and intestines through the skin; extensive injuries; but operative interference led to recovery.

Mr. T. Torkington Blease (50) reports a case of lacerated wound of the abdomen caused by the shaft of a gig. The wound was ten inches long and extended across the lower abdomen. There was a protrusion of the omentum and intestine, but no visceral injuries. Operation was followed by recovery.

McClellan's (51) case was a boy eight years old, who fell from the roof of a hen-house, striking on the corner of a board. There was a complete rupture of the abdominal integuments (through the rectus) and prolapse of small intestine, which was not only bruised and torn, but strangulated. Gut stitched to wound; recovery.

A. G. Walter (52) had a very interesting case of spontaneous rupture of the abdominal wall in an old lady 72 years of age. She had a very severe chronic cough. During a violent spell the entire wall gave way in the linea alba for a distance of four inches, permitting a pro-

lapse of small bowel. Suture was followed by recovery. He also mentions a case very similar to his, published by Dr. Edward Batwell in the *Medical and Surgical Reporter*, p. 533.

Maxwell (45) had a case of spontaneous rupture of the abdominal wall in a healthy Chinese infant, forty days old. There was no trouble at birth; the cord dropped off in a week. Shortly before entering the hospital, the child developed an attack of enteritis. On the night of January 14th, the bowel escaped from the umbilicus. Twenty hours later, the child was brought to the hospital, the prolapsed bowel cleansed, the wound enlarged, the intestines replaced — all without anæsthesia. Death six hours later. The pathology in this case, however, does not place this case in the same category with the one I report.

Döbbelin (46) published "A Case of Spontaneous Rupture of the Abdominal Wall and Bowel Prolapse," but this was a case of old, suppurating herniotomy wound, which, five years after healing, became again inflamed, and ruptured. No sac; reposition; recovery.

Naresh Chandra Mitra (47) of Bengal reports a case of a male Hindu who was admitted to the hospital for rupture of the abdominal wall, protrusion of the small intestines, and complete rupture of the bowel. The patient had suffered from ascites for a long time, and while attempting to stand up he tumbled down and the anterior wall of the abdomen was ruptured. The case is interesting because rupture of the abdominal wall in a case of ascites due to pure accident is extremely rare.

Equally interesting is the case reported by Thomas (48). The rupture involved not only the abdominal muscles, but the skin as well, thus opening the peritoneal cavity to the outside world. It is here recorded because of its important bearing on the mechanism of such injuries, as the only cause given is tympanitic distention of the intestines. However, the intra-abdominal pressure was increased, as the girl was three months advanced in pregnancy.

CASE 2. Mr. McI., admitted February 18, 1901. Patient is an Irishman, who, according to his own statement, was "about 56 years of age."

Eleven weeks prior to admission, he was run over by a milk-wagon, the wheel passing over the lower right portion of the abdomen and groin. He was confined to bed about one week. He never noticed any black and blue marks on the abdomen at any time. After this week in bed, his general condition seemed normal, and there was no noticeable local disturbance until about three weeks ago, when the patient noticed a lump about the size of a hen's egg near McBurney's point. He thought this lump came with a spell of coughing. No symptoms, except a little itching, were complained of until two weeks later, when the swelling "broke and discharged some matter." The separation of the skin exposed a dark tumor the size of a hen's egg. The bowels moved quite regularly, and gas passed daily, though during the past week there have been a few colicky pains and three attacks of vomiting.

Examination. Old man, not well nourished, with a high-tension pulse; abdomen rather flat. There was a tumor the size of an egg protruding through the skin, on a level with and two inches internal to the right anterior superior iliac spine. The mass was a dark red strangulated omentum with a neck 1½ inches in diameter. There was some suppuration about the base. As the mass seemed to fluctuate, it was carefully incised. It contained nothing but a collection of blood in the center. It was therefore cut off close to the abdomen, the area well cleansed, and an antiseptic dressing applied. The stump bled very little when cut.

Operation. A few days later, the area being covered with healthy granulations, the patient was anæsthetized and the wound curetted and sterilized with pure carbolic acid. An elliptical incision was made in the healthy surrounding skin, the wound packed with gauze, and the proximal skin edges closed over the packing. The peritoneal cavity was now entered above, and the entire ring gripping the omentum cleared and drawn into the wound, after which the abdominal cavity was protected with gauze packing. The omentum was now ligated in sections. A knuckle of colon was caught in the ring in the center of the omentum, producing angulation of the large bowel. In freeing the knuckle the friable peritoneal and muscular coats of the bowel were torn off for an area one half by three quarters of an inch. This was immediately closed over with catgut. In this way the entire infected area was dissected out without the least contamination.

The wound was closed in tiers, like any laparotomy wound. Formalin catgut was used for the peritoneum and chromic gut for the muscles and fascia. There was no special tension on the tissues. No drain; dry dressing. Patient put to bed in good condition.

The hernia had evidently occurred as the result of a partial rupture of the aponeurosis of the external oblique and a localized rupture of the muscular portion of the internal oblique and transverse muscles. There were muscle fibers all around the ring. There being no sac, the peritoneum must have ruptured too, and what blood escaped must have gone into the abdomen, hence no visible ecchymosis. The hernia occurred later at this weakened point as a result of tension due to coughing. The infection was doubtless due to transmigration of germs through the wall of the injured knuckle of colon.

The subsequent course for two weeks was uneventful. The skin stitches were removed on the tenth day. Four days later, the wound gave way for about an inch in the center, allowing a knuckle of small bowel to escape. The lips of the wound were free from infection, and in appearance resembled a plaster mold, there being no attempt at union. Resuture in tiers, without drainage, led to primary union.

Rupture of the Abdominal Muscles

Abstract and Review of Literature

Definition. By "muscular rupture" we understand a dissolution of continuity in the body of a muscle, due to excessive muscular activity. The accident may be associated with blunt outside force, or with some disease of the muscle itself which renders it more liable to rupture, but under this definition are excluded all dissolutions of continuity in muscle due to sharp instruments, etc.

Muscular rupture, as understood here, is an accident due partly to the power of contractility of the muscle, and is an accident peculiar to muscular tissue, because it is made possible by the physiological properties of muscular tissue.

Historical. It is not possible to trace the knowledge of subcutaneous muscular rupture back to Hippocrates. This is rather interesting, because subcutaneous muscular rupture must have been a frequent accident among people devoted to athletics and sports, as were the Greeks of his time. Hippocrates applies the term *τάλεῦβα* for both muscle and nerve (although not always), and it may be a question at times which structure he means, but even at that, there are no references to subcutaneous rupture of muscles anywhere among his writings.

In listing the diseases of muscles known to the Hippocratic school, Haeser (17), in his history of medicine, includes also "rupture." Maydl (27), however, believes that this is due to a faulty translation of a term which would be better translated as "wound." [1]

Galen (13), whose conception of the various anatomical structures and their physiological import was much clearer, nevertheless fails to report anywhere a clear diagnosis of rupture of muscle or ligament.

[1] The term in question is "trauma" (*τραῦμα*), and is interpreted by the early Latin translator as *vulnus*, which also accords with Maydl's view.

Only in one paragraph, where he speaks of the patella, Galen mentions accidentally an observation which evidently refers to a rupture of the ligamentum patellæ.

However, the first clear mention of tendon rupture is a matter of comparatively recent history. J. L. Petit (31) is generally credited with being the first clinician to mention the subject; in 1722 and in 1728, respectively, he reported clinical observations on the rupture of the tendo-Achillis, ligamentum patellæ, and the tendon of the quadriceps femoris.

Other clear observations on the subject have been found by Régeard to date back to the same period.

Régeard (34) wrote his thesis in 1880. In this work, which stands as a very careful study to the topic, he concludes as follows: "We must state, therefore, that, with the exception of J. L. Petit, muscular rupture was unknown to the older writers. All their writings show that even when they hinted at this condition, they invariably confounded it with other conditions. Their silence on the topic, therefore, does not indicate ignorance as much as mistaken diagnosis, which was due to theoretical and preconceived doctrines."

In 1781 (February 16th) Roussille Chamserée,[2] and in the following year (April 11th), Faguer, Sr.,[1] spoke at the Royal Academy of Surgery on the topic of this paper. At that period, however, there was no clear distinction made, as yet, between muscular and tendon rupture.

The first thorough essay on the subject was prepared by Sédillot (39) in 1786, but later, in 1817, he rewrote his work and brought it up to date.

From that period on, the subject is more often mentioned in the periodical literature, as well as in text-books. Gradually a distinction is made between muscular and tendon ruptures, and clinical cases begin to accumulate.

In the light of our present knowledge of the subject, it is highly probable that nearly all so-called muscular hernias are really pseudo-hernias, due to an irregular consolidation of a ruptured muscle. In other words, rupture of a muscle may lead to a muscular pseudo-hernia, and is often diagnosed as such.

[2] Memoirs published in Sédillot's work; q.v.

C. Lyot (25) suggests that certain muscular osteomata may be traced back to old ruptures.

In his extensive work on subcutaneous rupture of muscles and ligaments, including fractures, Maydl (27) endeavors to demonstrate that the mechanism of the accident is similar for the muscular, tendinous, and osseous structures. We shall have occasion to refer again to his work when discussing the mechanism of muscular rupture.

CASES

Régeard (34) collected from the literature fourteen cases of rupture of the rectus abdominus muscle, and added to these a case that came under his own observation.

Maydl summarized these cases, and added a new case from the literature. The sixteen cases stand reported as follows: Chaussier (6), Richerand (36), Lachapelle (22), Boyer (2), Bonnet (1), Richardson (35), Legouest (24), Després (8), Régeard (34), and Sédillot (39), one case each, and Larrey (23), Vidal de Cassis (3), and Maffre (26), two cases each.

The immediate cause of the accident is given as parturition in two cases, tetanus in one case, coitus in a second, vomiting in a third, knock-out punch in the abdomen in a fourth, jumping in a fifth, falling into water (with abdomen forward) in a sixth; the other accidents were occasioned by muscular overstrain caused by such actions as lifting, or attempts to avoid falling or injury.

The seat of the injury is indicated as follows: In the upper parts of the muscle; partially, in the region of the navel; 4 cm. over the navel; 3 cm. over umbilicus (partial rupture); upper region; 3 cm. above the symphysis; 2 cm. below umbilicus; right upper side; over the navel; 7 cm. over the navel; near the middle; over the navel; three fingers to the side of the navel; and in one case the muscles were ruptured on both sides.

The symptoms as reported were not similar. Thus, while ecchymosis was present in two cases, with swelling in one and hernia in the other, it is expressly mentioned in another case that there was neither swelling nor ecchymosis, but sinking. Another case with sinking was complicated on the third day by inflammatory swelling. In one of the cases sinking was the only symptom following the injury, and in another the sinking persisted even after recovery from injury, which was brought about by medical and mechanical means (complete relaxation and rest, narcotics); hæmatoma was the chief symptom in two cases, one of which was complicated also with muscular tumor. In one case, where no symptoms showed at the time of the injury, hernia developed later.

In only two cases were audible noises caused by the rupturing muscles. In one, sinking was followed by hernia; in the other, the most serious of the series, hæmatoma developed, and also symptoms of incarceration. The epigastric artery was ruptured, also the fascia, and the treatment was operative. In all the other cases in which the treatment is indicated, it was medical and mechanical: rest, resolvents, compresses, to which was added water-cure (?) in one case, cataplasmata in another, etc. Simultaneous injury of the spinal cord is mentioned in one case as a rather unusual complication. The accident occurred while the patient attempted to avoid a fall backwards. Nothing definite is given as to the duration, treatment, or outcome of this case. The duration is noted in five cases; it was one month in two cases, fifteen days in two, and three weeks in one case.

Death followed in four cases. Six cases recovered, two recovered partially, and one case was on the way to recovery at the time of the report. The final outcome is not given in three cases.

Post-mortem findings are given in the cases reported by Boyer (2) and Larrey (23). Boyer found the rectus abdominis ruptured on the left side; the gap measured one inch, and there was some blood effusion between the severed edges. Muscular efforts during vomiting caused the subcutaneous rupture of the abdominal muscle in this case.

In Larrey's case the accident and death was due to tetanus. A tumor, which formed during life, was found at post-mortem examination to be due to a severe contraction of a portion of the pubosternal muscle. The muscle was severed through its whole thickness below, and the gap was filled with dark, coagulated blood.

Jankowski (19) studied the occurrence of subcutaneous rupture of the abdominal muscles in typhoid fever. He reports a case in which

such rupture occurred on the twenty-fifth day of the disease. The rupture was bilateral. At the Charité in Berlin the rupture was found 11 times among 202 post-mortem examinations following typhoid fever, from 1859 to 1868. Jankowski believes that the frequency of its occurrence varies in different years. Thus, he points out that in 1859 twenty necropsies showed rupture of the abdominal muscles four times, while in 1868 the accident was found to have occurred only in three cases among a total of thirty necropsies.

Dupuch-Lapointe (11) reports a case of partial rupture of the right transversus and obliqui muscles, caused by a fall on a hard object. Immobilization was followed by speedy recovery.

Larrey (23, *c*) reports a case of partial rupture of the obliqui caused by a blunt force striking against the os coxæ. Immobilization with elastic bandage led to partial recovery.

Plaignaud (32) found a rupture of the transversus and obliqui muscles at the region of the umbilicus and to the outside of it, caused by a fall from the fourth floor. The patient died, and Plaignaud found not only the muscles ruptured, but the peritoneum as well, leaving a gap that measured three inches, so that the intestines were immediately beneath the skin. Considering the extent of the injury, there was very little hemorrhage.

The case reported by Vidal de Cassis (3) in his *Pathologie Externe* is worthy of particular mention because of its bearing on prognosis.

The patient received the injury during coitus. One month after the accident, patient returned to his usual work, and soon he noted a tumor below the umbilicus and towards the right side. The tumor was particularly large while the patient was standing and after meals, and it disappeared in the recumbent posture. It was a subcutaneous hernia, and the patient was instructed to wear a proper abdominal bandage.

Charvot and Couillault (5), surgeons in the French army, have made a study on muscular ruptures, based on twenty cases observed by them in the army, among cavalrymen. Of these, fourteen were ruptures of the abdominal muscles, mostly all involving the rectus abdominis.

They have made the following generalization, which, they suggest, may apply to civil practice as well, although their observations are limited to military practice.

1. Muscular ruptures are observed almost exclusively among young soldiers at the time when they receive their first practical class instruction.

2. The accident occurs generally among those who are not used to gymnastics and horses.

3. Usually the patient gave no previous history of traumatism which might have weakened the resistance of the muscle. The injured muscles were presumably healthy.

4. Muscular ruptures are seldom total. Usually they are partial and successive; that is, new fibers rupture whenever the patient repeats the same exercises in horse-riding.

5. To each particular movement there corresponds a lesion of the same muscle, which is generally ruptured at the same point.

In the case of the authors' patients, the rectus abdominis ruptured nearly always at the same exercise; namely, jumping on the horse.

Finally, the authors conclude that "a muscle is most likely to be ruptured where it enters into a movement to which it is not accustomed, because the various muscular fascia of which it is composed, not being drilled by long habit, may fail to contract synchronously."

Thus in the case of the rectus abdominis, the authors find that it is ruptured usually when it acts as an elevator for the basin. In nearly all their cases of rupture of the rectus abdominis, they found that the accident occurred during the act of jumping on the saddle without the use of the stirrup. The young soldier, inexperienced, fails to lift his body by a proper jump to the height of the horse; in his efforts to accomplish the deed, the sternopubic muscles contract to lift the basin, and at this time the rupture occurs.

What these authors say concerning the ætiology and mechanism of rupture of the abdominal muscles suits, also, the three cases of rupture of the rectus abdominis reported by their colleague in the army, Tartière (40).

The case reported by Gray (14) in 1864 is of a different character. The patient was standing on the rail in front of an engine when it was put in motion and he received a violent

blow on the abdomen from the buffer. A tumor appeared in the center of the abdominal region, intense pain developed, also vomiting, and, twenty hours after the accident, the patient died.

At the post-mortem examination, "the tumor was found to consist of several coils of intestine, which had passed through a rent in the abdominal muscles, five inches in length. The rent was somewhat oblique, and included the rectus muscle on the left side, with the epigastric artery, the linea alba (crossing it just below the umbilicus), and the greater portion of the rectus of the right side. The peritoneum was torn to an extent corresponding to the laceration of the muscles; but the intestines and the skin, with its sublayer of fat, were unaffected by the injury."

Turning our attention to English and American literature, we find comparatively little on the subject. The same is true of recent literature in general.

Besides the study of Härting (18) on subcutaneous muscular rupture and muscular hernias, published in 1896, there has been no important monograph on the subject since Maffre's study on the tearing of the anterior recti muscles of the abdomen, which he published in 1879.

The mechanism of the rupture of the abdominal recti muscles was more recently studied by Mohr (28) (1902). With this exception, recent medical literature contains little more than a few isolated reports of single cases.

Thus, R. H. Charles (4) reports a case from Calcutta, India, in which a football-player obtained an extensive rupture of the rectus muscle while kicking a ball. At the operation, which was performed nearly three weeks later, it was found that "the rectus muscle had ruptured at the site where it becomes tendinous, and had contracted, and, curling upon itself, had left a longitudinal space and corresponding depression four inches long between the torn ends of muscle." A bursa had formed at the free end of the muscle, and, upon incising it, about one ounce of fluid escaped. Previous to operation the curled end of the muscle formed a subcutaneous firm swelling, the size of a billiard-ball. The patient recovered.

At a meeting of the military surgeons of Vienna (held December 6, 1902), Jeney (21, *a*) presented two patients who were operated on for epigastric hernia caused by muscular rupture. Both patients were soldiers, and in both the accident occurred during equestrian exercises as a result of muscular efforts. There was sudden epigastric pain, vomiting, feeling of oppression, nausea, especially marked when corporeal exercise was attempted.

The diagnosis of "stomach trouble" was entertained until the patients entered the hospital, when the true nature of the cases was revealed. Objective examination showed a subcutaneous swelling, very sensitive to touch, the size of a hazelnut, but increasing with increased intra-abdominal pressure, occupying the middle line, half-way between the umbilicus and the symphysis pubis. The hernial mass was found to be chiefly preperitoneal fat. Operation was followed by recovery.

At a meeting of the same society (held April 4, 1903), Jeney (21, *b*) showed a case of subcutaneous rupture of the abdominal rectus muscle, caused by a similar accident; namely, high-jumping exercises. On the right side the rupture involved the lower half of the muscle; on the left side the rupture was found under the arch of the ribs, right above the highest inscriptio tendinea.

Müller (29) reported a case of muscular rupture which involved the external oblique of the abdomen.

Poper's case (33) was a subcutaneous rupture of the abdominal rectus muscles.

Demoulin (9) reported from the surgical clinic of Professor Duplay at the Charité Hospital a case of partial rupture of the abdominal rectus. The rupture occurred while the patient attempted to hang a sack of potatoes on a hook. There was sudden pain, the patient assumed a recumbent posture, and a large tumor developed below the umbilicus, somewhat to the right of the median line, which was the body of the ruptured muscle.

Rabagliati (49) draws attention to muscular rupture around the umbilicus which he distinguishes from umbilical hernia, because it is not extensive enough to permit protrusion of omentum, peritoneum, or intestine. It is a condition often met with in adult women, and usually mistaken for colic, muscular rheuma-

tism, etc., as was the case with two cases he reports. In both cases he operated on, bringing the edges of the umbilicus together, and the result has been most satisfactory. He mentions nothing as to the pathogenesis of the condition.

The case reported by Eisendrath (12) is one of extensive laceration of the abdominal muscles, just above the crest of the ilium, with a large hernia at that point, formed by intestine, and separated from the outside world only by skin. After operation the patient made a rapid recovery.

That subcutaneous rupture of the abdominal muscles is not always diagnosed during life is well illustrated by the post-mortem findings in a case reported briefly by Wells (41). The patient had died of lobar pneumonia. Both recti muscles were found ruptured, and showed a "pale, hyaline appearance for some distance from the point of rupture." During life, there were no evidences of rupture, and no evident cause could be given for the occurrence.

ÆTIOLOGY OF MUSCULAR RUPTURE

Muscular rupture may be only a trivial accident among manual laborers when only a few fibers are torn. On the other hand, in its grave forms, such as when a great portion or all of its thickness is involved, muscular rupture is a rare accident.

It is evident from the nature of the accident that it is met with but rarely among women and children, except where the accident was preceded by some well-defined pathological changes in the affected muscle.

It is therefore necessary to distinguish, from an ætiological standpoint, two varieties of muscular rupture: 1. Pathological ruptures, such as follow some pathological changes in the muscle due to disease; and 2. Functional ruptures which involve muscles otherwise healthy, as a result of excessive muscular activity, associated or not with outside force.

PATHOLOGICAL RUPTURE

Changes in muscular tissue in the course of high fever have been observed clinically, first by Velpeau, and have been studied clinically and pathologically by Zenker (42) and Hayen. From them we have learned that the involved muscle loses its properties of contractility and cohesion at the level of the degenerated portions, and it is at such points that rupture occurs during contraction of the healthy portion of muscle. In such conditions the hard muscular efforts on the part of the patient, such as defecation, vomiting, coughing, or an attempt to rise in bed, may be followed by a rupture of the abdominal muscles. Such accidents, however, belong, properly speaking, to sequelæ of myositis, according to Lyot.

Functional rupture is so called because the accident is due to muscular activity, and occurs in muscle which has not been changed pathologically by disease.

Lyot (25) suggests the name of "professional rupture" for such accidents as are common to certain professions. Thus subcutaneous rupture of certain muscles is a common accident among cavalrymen in the army. Charvot and Couillault (5), who studied the subject in the French army, found, among twenty cases, fourteen ruptures of the rectus abdominis, two cases of rupture of the anterior rectus of the thigh, and a case of rupture of each of the following muscles: deltoid, the abductors, pectoralis major, and the great abdominal oblique.

The mechanism of muscular rupture has been variously explained. Rupture has been confounded for a long time with tearing the muscle, and the same mechanism has been ascribed to both accidents; namely, excessive lengthening of the muscle. Numerous observations have shown, however, that the contrary is the case, and it is generally believed to-day that muscular rupture always occurs during contraction, as was first maintained by Reydellet and Cruveilhier. From the physiology of muscle we know that muscular tissue has a great power of tenacity and cohesion; consequently we are forced to admit that something irregular occurs during contractility which renders the muscle liable to rupture. Investigations point to the following theories:

1. Involuntary and unconscious contraction of muscle (Sédillot and Jarjavay).

2. Isolated contraction of a single muscle in a group of muscles which usually act together (Gubler's theory).

It is probable that both conditions — sudden contraction and lack of co-ordination in mus-

cular tension — often concur in the pathogenesis of muscular rupture.

The normal physiology of muscular activity is as follows: When a movement is about to take place, there is a preparatory period, during which the muscles which are to take part in the action, as well as their antagonists, receive the necessary nervous impressions, and several muscles begin to contract in harmony, all at the same time; the amount of contraction for each muscle is dependent upon the action required, and varies also according to the position of each muscle, respectively, with reference to the common lever; at the same time, the antagonistic muscles regulate the movements, and assist the concerted action by a slight resistance. The contraction is effected in each muscle by a series of muscular jilts, which cause a characteristic noise, perceptible to auscultation.

But when the movement is fast and unexpected, as in the efforts to prevent a fall, the process is disturbed. The muscular contractions follow each other irregularly and faster, and may reach in some muscle, or bundle of fibers, a state of tetany. Co-ordination not being perfect, some bundle of fibers or muscle may act singly, and rupture under the strain, or a segment of muscle may have not reached the contractile stage, being "taken by surprise," and the rest of the muscle contracting may rupture this weaker segment.

Such is the accepted view on the mechanism of muscular rupture. But there are other views that merit attention. As early as 1821 Roulin (37) formulated the view that "rupture occurs only in a contracted muscle, but it is not due solely to its own contraction. It is most likely to occur when its power of contraction is outweighed by the simultaneous action of a more powerful antagonistic muscle."

Rust (38), who paid a great deal of attention to this subject, associated himself with the views first advocated by Roulin.

Bichat[1] maintains that "all muscular rupture is associated with excess of exterior movement, which distends, and acts on the muscular fibers, causing them to contract tighter in their tendency to oppose distention."

Maydl (27) finds that the "rupture is conditioned by two equally important factors; the absence of any of these two would render impossible the occurrence of rupture. One is passive stretching of a contracted muscle by the weight of the body, or by some exterior force entirely foreign to the body, and the other is the action of the antagonistic muscles."

Gussenbauer (16) is of the same opinion as Maydl. He says: "Stretching and rupture of muscle is met with often enough, where a contracted muscle is being stretched at the time of its maximum contractility, as is not seldom the case at jumping, or lifting heavy weights. Rupture of muscle due only to muscular contraction is observed almost exclusively in degenerated muscles."

Sédillot (39) believes that contraction of a segment of a muscle associated synchronously with some antagonistic force invariably leads to partial muscular rupture, while Jarjavay (20) maintains that this is also the mechanism of total rupture. Gubler (15) explains the occurrence of muscular rupture in much the same manner; he adds that separate innervation of different muscular segments may have something to do with powerful contraction of some segment of muscle, causing rupture at some point in the rest of the muscle, which, being relaxed, is too weak to stand the stretching.

Régeard (34) draws attention to the fact that the impulse for contraction, beginning in the terminal nerve buds, travels rapidly all along the muscle, and suggests that a contracting portion exercises a pulling action on the immediately following portion before the latter caught the impulse to contract. Should this pulling or stretching, or in other words, the propagation of the impulse to contract, follow too rapidly, it may lead to rupture of muscular fibers.

Rust (38), as early as 1834, had the following to say concerning the mechanism of muscular rupture:

"It is always caused by excessive muscular activity. Absolute and often-repeated relative disturbance of the relation between muscular and antagonistic forces is always the case, and is caused by many circumstances. Sometimes the rupture is favored by an unfavorable position of some member of the body, by one-

[1] Cited by Jarjavay; q.v.

sided or unequal contractions, . . . by unexpected, sudden, half-conscious contractions, by an abnormal influence of the will-power, . . . or by a pathological activity."

The lack of nervous co-ordination of muscular activity as a factor in muscular rupture is referred to in a more definite form by Nélaton (30). In his *Elements of Surgical Pathology*, Nélaton says: "Whenever a rupture follows an instinctive (subconscious) movement, or even a voluntary but violent and sudden muscular effort, it is the result of a temporary suspension of the correlations established by the sensory nerves between the brain and the muscles."

Le Dentu also accentuates the nervous influence; a factor which remains unmentioned by most writers on the subject. He agrees throughout with Nélaton, who says further, that "muscular fibers may rupture after they have contracted, whenever a mechanical force, greater than that which caused their contraction, is suddenly brought to bear against their contracted state."

We may mention, more for its historical interest, the views held by Delpech (7), who maintained that muscular contraction at the time of rupture is an exception, but that the muscle is generally ruptured while at rest by the sudden and powerful contraction of its antagonists.

PATHOLOGICAL ANATOMY

A muscle may rupture in three different points: in its muscular, musculo-tendinous, and tendinous portion. It is generally known that the body of a muscle is more resistant than its tendinous portion. Only in disease, such as high fever, the reverse may be the case, and muscle may become more liable to rupture than tendon. It is probable that the musculotendinous portion is the most frequent seat of rupture. Among twenty-one cases, Sédillot noticed that such was the case in fifteen.

Lyot draws attention to the fact that the same muscle ruptures usually at the same spot in a given number of cases. For each muscle, in other words, there seems to be a locus minoris resistentiæ; a spot liable to rupture more than any other portion of its extent. Thus the rectus abdominis usually ruptures along its surface below the umbilicus, where there are no muscular intersections to strengthen its own fibers.

Furthermore, we may distinguish three degrees of muscular rupture:

1. Fibrillary rupture; 2. Partial rupture; and 3. Total rupture.

Fibrillary rupture is of frequent occurrence, and is often overlooked, as it does not cause excessive pain, and it does not render the patient unable to continue his vocation. It consists of the rupture of a few fibrillæ, giving rise to a slight interfibrillar hemorrhage and infiltration, which is not easily recognized, on account of the healthy intervening fibers.

Partial rupture consists in the rupture of one or more muscular fasciæ, and is more frequent than total rupture. At times, the ruptured muscular fasciæ are those on the surface of the muscle; again, they may be hidden by healthy fascia or strata of muscle. In cases of this nature, hæmatoma is usually present. The edges of the ruptured portion of the muscle are at some distance from each other, and the gap is filled with blood-clot.

Sometimes the rupture involves large arterial branches, and in such cases abundant hemorrhage is the rule. Such is the case reported by Richardson, where the epigastric artery was ruptured, and upon opening the abdominal cavity, presumably for a hernia, he split open a hæmatoma, which contained a liter and a half (French measure) of blood.

Complete rupture occurs at times, leaving a wide gap, which soon fills with blood.

In such cases the aponeurosis usually remains intact, walling off the blood. When it ruptures, extensive ecchymosis follows the accident.

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COOK COUNTY HOSPITAL

Department of Pathology

SECONDARY SARCOMA[1]

Multiple Large Pleural and Pulmonary Secondary Growths Following Primary Periosteal Sarcoma — A Supplementary Report to That of Dr. Besley

By G. A. DOWLING, M. D., Chicago
Resident Physician, Cook County Hospital

THE following report of a case of sarcomata of the lungs and pleuræ, secondary to sarcoma of the tibia, is of interest, supplementary to the previous report by Dr. Besley.

On November 23, 1905, this boy, aged 15, re-entered the hospital to the service of Dr. Miller, and at that time gave the following history: That he was taken sick eight weeks before (seven months after leaving the hospital) with a heavy cold, and pain in the right side of the chest. This pain was worse on coughing and on deep inspiration, and at first ascribed to the use of his crutch. He complained also of some pain in the left side of his chest. Following the onset, he coughed and expectorated considerably, and for a short time previous to admission had been rather short of breath.

He vomited nearly every day, his appetite was poor, and he had been very constipated; urinations had been frequent; he had been feverish part of the time, but without distinct chills. He had always been in rather poor health, and a tumor of his right knee following an injury the previous December had necessitated amputation through the thigh.

Examination showed a poorly developed and poorly nourished boy, rather anæmic in appearance; he sat up in bed, breathing hurriedly and in evident distress; the skin was hot and dry; there was no œdema of the extremities; the right leg had been amputated through the middle third of the thigh. The head and neck showed nothing abnormal, except the anxious facial expression and dry, sore lips.

There was little expansion of the right side of the chest, with dullness, almost flatness, reaching anteriorly to the clavicle and posteriorly to about one inch above the lower angle of the scapula, but there was some resonance at the apex. Over the dull area, breath and voice sounds were absent. Vocal fremitus was exaggerated above the flat area behind. Over the left lung, at the base and side, there was some shifting dullness, with diminished voice and breath sounds. Precordial dullness extended to the nipple line on the left side; the tones at the apex were loud, and both aortic and pulmonic second sounds were accentuated.

Marked tenderness was present on attempting palpation of the abdomen below the right costal arch, also resistance, but the liver was not palpable, nor the spleen, although they were probably enlarged at that time. The extremities were negative, except for a marked clubbing of the fingers and the above-mentioned amputation stump.

Following his entrance to the hospital the patient exhibited an irregular temperature, which varied between 99° and 103° F. He coughed a great deal, suffered extreme dyspnœa, and complained of much pain in the right side of the chest and abdomen. Repeatedly, examinations of the sputum for tubercle bacilli were negative.

The urine showed some albumin and a few hyaline and granular casts. A blood examination on the day of entrance showed:

Erythrocytes	4,000,000
Hæmoglobin	60% (Talquist)
Leucocytes	8,000
Polymorphonuclear neutrophiles	68.7%
Small mononuclears	23.3%
Large mononuclears	4.7%
Eosinophiles	3.3%

His temperature became normal after three weeks of rest in bed, but pain, dyspnœa, and emaciation became more marked, as did also the areas of dullness in the right chest. Death occurred December 31, 1905.

At the post-mortem examination made January 2, 1906, by Dr. Le Count, the following anatomical diagnosis was made:

"Metastatic osteosarcoma of the pleura and lungs; compression atelectasis of the right lung; dislocation of the heart, spleen, and liver; metastatic osteosarcomata of the intestinal peritoneum and mesentery; chronic hyperplastic splenitis; passive hyperæmia of the kidneys; emaciation and anæmia.

"Of special interest were the conditions found in the thorax, not only as regards the form, size, and location of the tumors, but also the remarkable dislocation of the various intrathoracic organs, and of the liver and spleen as well.

"On removing the breast-plate, the right lung is found completely collapsed and occupying a very small space at the upper part of the cavity, while the cavity itself is completely filled with a solid tumor, everywhere adherent to and apparently arising from the parietal pleura. The left pleural cavity contains several pedun-

[1] Surgery, Gynecology and Obstetrics, November, 1905, vol. i, p. 412.

culated tumors of varying size, of the same consistency as that in the opposite cavity, but differing, in that their pedicles connect them with the visceral pleura, while the one previously described is not pedunculated, and apparently arises from the parietal pleura. The left lung at its lower border crepitates in spots, and only feebly in its upper portion. In the substance of the lung, and extending to the surface, hard nodules can be felt.

"The heart has been pushed far to the left, so that its right border is at the left border of the sternum. It is normal in size, but of flabby consistency. The liver with the diaphragm has been so pushed downward that its upper border is three centimeters below the costal arch, while its lower border is two centimeters below the umbilicus. The omentum is curled up, and occupies the epigastric region. The peritoneum of the intestines and mesentery contain numerous small raised nodules, and the retroperitoneal lymph-glands are enlarged.

"The largest of the numerous growths springing from the pleuræ takes its shape from that of the right pleural cavity, being irregularly pyramidal, with the blunt apex above, and surmounted by the fully collapsed lung. It is, however, somewhat larger than the normal pleural cavity for a boy of this size, the chest-wall having been forced out, the diaphragm down, and the mediastinal partition to the opposite side. In color it is pinkish white, mottled here and there with small darker areas of hemorrhage. To the touch it is very firm, except in the very center, where a small area is softened. No evidence of encapsulation exists. On section, the whole tumor appears to be of the same structure, modified only by hemorrhages and softening. Numerous minute spaces are seen on the cut section, but no definite vessel-wall can be demonstrated for any of them.

"In addition to this large tumor of the parietal pleura, the right lung is further compressed by one as large as a small fist, which has grown within the substance of the lower lobe. The upper and middle lobes have also numerous smaller tumors within their substance, and several nodules of the size of hazelnuts on their surfaces.

"Practically free in the left pleural cavity is a mass, likewise irregularly pyramidal, attached only by a thin pedicle to the posterior surface of the lower lobe. No other growth occurs in this lobe, but the upper lobe shows numerous tumors, the largest of the size of a hen's egg, and coming to the surface in the interlobar fissure. Another, but smaller, pedunculated tumor occupies a position between the superior mediastinum and the upper lobe of the left lung, its pedicle attaching it to the root of the lung. All these smaller tumors correspond in general with the description of the larger one, except that the pedunculated growths have definite capsules."

Upon histological examination of the metastatic growths, their structure is essentially that common to chondrosarcomas, very little evidence of ossification being found. Moreover, there is an absence, as one might expect, of the layer upon layer arrangement common to the primary tumors of this type. Cells with dividing nuclei are quite numerous, as are also the blood-vessels.

COOK COUNTY HOSPITAL

Department of Pathology

MULTIPLE ANEURYSMS OF THE LARGE VESSELS

With Report of a Case

By C. F. YERGER, M.D., Chicago
Resident Physician, Cook County Hospital

WHILE aneurysms of the arch of the aorta not infrequently have associated with them other aneurysms of the thoracic or abdominal aorta, yet the association of such aneurysms with similar lesions of other large vessels is rare.

In a review of the records of three thousand six hundred consecutive post-mortem examinations held at this hospital, which includes eighty-five cases of aneurysm of the heart, aorta, or other large vessels, there were found eight cases in which the aneurysms were multiple, of which the following are brief synopses:

Case 1. Aneurysm of the arch of the aorta and rupture of an aneurysm of the abdominal aorta 5 cm. above its bifurcation, with extraperitoneal extravasation into the left side of the abdominal and pelvic cavities.

Case 2. Aneurysm of the descending arch and abdominal aorta. In the descending arch of the aorta, about 5 cm. below the left subclavian artery, on its posterior aspect, is an aneurysm about the size of a hen's egg; about 5 cm. below this, an aneurysm of the abdominal aorta.

Case 3. Multiple aneurysms of the arch of the aorta and aneurysm of the abdominal aorta. There is an aneurysm the size of a large walnut 3.5 cm. above the aortic valves; another aneurysm, not so large, is situated just above the former. Several smaller aneurysms are located in the transverse arch. A small aneurysm is situated in the abdominal aorta.

Case 4. Fusiform aneurysm of the ascending arch of the aorta, and a saccular aneurysm of the descending arch, with rupture into the œsophagus and secondary hemorrhage into the stomach.

Case 5. Aneurysm of the entire arch and aneurysm of the abdominal aorta. Above and to the left of the pericardium is a large, pear-shaped aneurysm compressing the left lung. Another smaller aneurysm is formed in the upper portion of the abdominal aorta just below the diaphragm.

Case 6. Aneurysms of the thoracic and abdominal aorta, with rupture of latter. Two small aneurysms are situated at the root of the aorta. Another aneurysm is situated in the abdominal aorta at the level of the last dorsal vertebra. This aneurysm has ruptured, forming a retroperitoneal cavity below the diaphragm beneath the right kidney, and extending backward to the skin, filled with blood. This has burrowed into the retroperitoneal tissues behind the kidney down to the iliac vessels and Poupart's ligament into the left inguinal region and thigh.

Case 7. Aneurysm of both internal iliac arteries. In the beginning of each internal iliac artery there is an aneurysm 3 cm. in diameter, completely filled with organized blood-clot.

Case 8. Two aneurysms of the thoracic aorta and one of the cœliac axis. In the thoracic aorta there are located two aneurysms; the larger has eroded the bodies of the seventh, eighth, and ninth dorsal vertebræ. Another aneurysm, 11 cm. in diameter, is situated at the cœliac axis, involving the splenic and hepatic branches.

To these observations the following account of an additional case, recently observed, may be added:

E. K., male, cook, German, 46 years of age, who denied syphilitic infection, and had used alcoholic beverages and tobacco with moderation, was admitted to the hospital, August 21, 1902. He stated that seven months prior he noted an enlargement in the left popliteal space, about the size of a hazelnut. This caused no discomfort until about five months later, when it became painful. At this time, examination showed "a pulsating tumor about the size of a small orange in the left popliteal space. A bruit is readily heard over the tumor and along the course of the vessel. The pulse in the dorsalis pedis is very much reduced in volume. The lower portion of the left thigh and leg is considerably swollen. The heart is negative, except for a reduplication of the aortic tone."

The diagnosis of popliteal aneurysm was made, and on August 23, 1902, the sac was removed after preliminary ligation of the distal and proximal vessels. In November, gangrene of the leg necessitated amputation. This was performed at the middle third of the thigh. The patient made an uneventful recovery, and was discharged from the hospital, February 2, 1903.

Three years later — September 1, 1906 — the patient re-entered the hospital, and stated "that during the past month he had gradually become hoarse. This was later accompanied by a loud, brassy cough, a constant substernal pain, choking sensations, and dysphagia. Examination at this time showed "the veins of the neck distended, the apex-beat not visible nor palpable. A

diastolic thrill is present at the base of the heart, dullness from the upper border of the sternum down to the third rib and to one inch to the right of the sternum, blending with the cardiac dullness, which extends one half-inch outside the nipple line to the left, and on the right to the mid-sternal line. Auscultation reveals an aortic diastolic murmur and accentuation of the second pulmonic tone. Evidences of marked arteriosclerosis are present in the palpable arteries. Laryngoscopic examination shows paralysis of the left recurrent laryngeal nerve."

The clinical diagnosis of aneurysm of the arch of the aorta was made. The patient died October 15, 1906, and at the post-mortem examination the following conditions were found:

Sacculated aneurysms of the arch of the aorta and abdominal aorta; diffuse nodular sclerosis of the aorta and its larger branches; erosion of the trachea; œdema of the left vocal cord; fibrous myocarditis; parenchymatous nephritis; purulent aspiration pneumonia; atrophic cirrhosis of the liver; chronic interstitial splenitis.

There are three saccular aneurysms in the aorta, all having their longest diameters corresponding to the long axis of the vessel. The largest is located in the ascending portion of the arch of the aorta, a second in the transverse, and another in the abdominal aorta. 3.5 cm. above the attached margins of the aortic valves there is an oval opening in the aorta, directed backward and to the right. This opening measures 3.5 by 2.5 cm., and is opposite the middle of a sac 9 by 6.5 by 6 cm., into which it leads. This sac is slightly oval, is full of clotted blood, and rests upon the lower portion of the trachea and its bifurcation and the œsophagus. There is an erosion of the trachea on its anterior wall 5 mm. above its bifurcation. The right pneumogastric nerve lies posterior and the left pneumogastric lies anterior to the sac; the left recurrent laryngeal between the sac and the transverse arch. The superior vena cava and the right auricle are to the right and slightly anterior to the sac. The right innominate artery is given off from the transverse arch 2.5 cm. above the opening into the sac. The left carotid and subclavian arteries lie in front of the upper border of the sac. 3.5 cm. above the aneurysmal opening, opposite the point where the subclavian is given off in the posterior wall of the transverse arch, there is located another aneurysm. Its transverse diameter measures 4 cm., the vertical 2.5 cm., and the anteroposterior 1.5 cm. It presses posteriorly upon the left recurrent laryngeal nerve, the trachea, and the left bronchus for a distance of 1.5 cm., both proximal and distal to the bifurcation. The left recurrent laryngeal nerve is located posterior to this aneurysm, and between it and the left surface of the aneurysm of the ascending arch.

The heart shows some hypertrophy. The muscle of the left ventricle measures 13 mm. in thickness; the wall of the right ventricle, 8 mm.; the interventricular septum, 1.5 cm.

A third aneurysm is located upon the posterior and left lateral aspect of the abdominal aorta, near the origin of the left renal artery. Its largest diameter measures only 13 mm. There are also small dilatations in the iliacs and femorals and in the remaining popliteal artery. The arch of the aorta and its branches, the abdominal aorta, the iliacs, and the popliteal arteries show numerous nodular areas of almost cartilaginous consistency.

Re-examination of the material removed at the first operation from the left popliteal space shows a number of cuplike, concave, calcareous plaques, which evidently formed parts of the calcified wall of a false aneurysm. The largest of these is 6 cm. long.

A review of these nine cases would seem to indicate that the disease leading to the formation of aneurysms is a general one, at least more so than is generally understood by the clinical diagnosis of "aneurysm of the aortic arch." If the usually applied ætiology of aneurysms — syphilis — be assigned to these nine cases, they may be considered as examples of syphilitic disease of the large arteries with the occurrence at two or more points of localized dilatations. Were the ætiology of syphilis on a scientific basis, measures could be taken to determine whether such was their nature.

As might be expected, the majority of these aneurysms were multiple in the thoracic aorta, or aneurysms in this location had associated with them similar lesions of the abdominal aorta. In six of the nine cases, abdominal aneurysms were present; rupture occurred in three cases; in only one case were they multiple in vessels other than the aorta; in that case, in both iliacs.

COOK COUNTY HOSPITAL
Department of Surgery

THE OPERATIVE TREATMENT OF WOUNDS OF THE DIAPHRAGM

A Method of Exclusion by Transpleural Sutures

By E. WYLLYS ANDREWS, M. D., Chicago
Attending Surgeon, Cook County Hospital

WOUNDS or ruptures of the diaphragm are either rare or are rarely discovered, so that only about 79 operations are reported in the current literature. Six of these were lately added from the Innsbruck clinic of Schlosser, by an assistant, F. A. Suter. Previously, Neugebauer had collected 59 cases. Riese brought the number to 71, and Neugebauer again reviewed the subject, finding, in all, 73 cases. Neugebauer's statistics covered numerous miscellaneous operative cases; i. e., 3 thoracotomies, 2 laparotomies (by Schmidt and Seydel), also Riese's case of associated stab wound of a kidney, and 1 requiring resection of the tenth to twelfth ribs and suture of the diaphragm.

In Suter's more complete analysis we find: 57 transpleural operations, 54 recoveries — 3 deaths (5.26 per cent); 14 laparotomies, 10 recoveries — 4 deaths (28.57 per cent); 4 thoracolaparotomies (compound methods), 3 recoveries — 1 death (25 per cent).

The above totals, I think, include the scattered single cases occasionally appearing in the past decade, such as those of Borsuk, Glantenay, Amanti, Severeaun, and some others which I have seen mentioned, but cannot find at first hand.

We see at once from the above tables that thoracotomy stands far ahead of laparotomy or combined methods in low mortality. This may only indicate that it was done in a less severe class of cases than that of laparotomy. The latter operation would naturally be used in cases with abdominal injury — a much graver class than that of simple wounds of the chest.

It is interesting to note that only about five per cent mortality attended the intrathoracic operations, which must have involved temporary pneumothorax in most cases. This is directly contrary to what was formerly believed. It was thought from De Forest Willard's experiments that the inrush of cold air to the pleura was a very dangerous thing, causing sudden collapse, and even death from suffocation. It was, of course, known that this did not happen when the air entered very gradually. For my own part, I have ceased to dread this complication. I freely excise portions of the chest-wall when occasion calls for it (as in certain breast cancers). In former reports of lung surgery, I discussed this more at length.

I find that the lung does not even collapse in all cases when the pleural sac is entered, but remains in contact with the parietal layer, as if held outward by some internal force or by suction against the moist membranes. Even if the air does enter and some atalectasis occurs, no marked systemic effect is observed, unless pain and fear be present. Under anæsthesia, the pulse and respiration are comparatively little influenced by pneumothorax on one side.

Wounds and lacerations of the diaphragm may need suturing in connection with operations on the viscera above or below, or merely to prevent diaphragmatic hernia, which in all ordinary cases would be from below upward.

The following cases are of more than usual interest.

Case 1, below, is a beautiful example of diaphragmatic hernia brought about by a blow on the abdomen, unfortunately terminating quickly in death. Had the associated rupture of viscera not caused a fatal result, probably suture of the diaphragm from below or above would have saved life.

Case 2 is a recovery by operation from a stab wound of lung, diaphragm, and stomach, requiring three operative steps: 1. Closure of stomach

wound; 2. Suture of diaphragm; 3 (later). Removal of matter from pleura.

CASE 1. *Rupture of stomach; rupture of diaphragm; hernia into left pleura; peritonitis; rapid collapse and death.*

Henry McDermott, aged 50, fell, July 2, 1906, 25 feet, striking on occiput. He became unconscious. After three hours he was brought into the Cook County Hospital, semiconscious. Odor of alcohol on breath. Pulse 68, weak; respirations 20; temperature 98°, rectal. A scalp wound, 6 cm. long, over occiput, did not reveal depressed bone. Pupils equal; no paralysis. Patient rapidly became conscious. At first no abdominal signs were present. Not tympanitic or rigid. As consciousness returned, pain became intense in epigastrium. Much nausea, but unable to vomit. Abdomen grew rigid. Tympanites came on quickly. Great dyspnœa, and pain on inspiration. Urine negative. The left chest was hyperresonant, the heart being pushed to the right. It was evident that the lung was collapsed, and air had taken its place. Cyanosis and dyspnœa increased, and in eight hours the patient died, before operation was deemed possible.

Coroner's autopsy showed the brain negative. The peritoneal cavity contained a large amount of stomach contents. The stomach was ruptured near its cardiac end, on the anterior wall and greater curvature. The diaphragm was ruptured into the left pleural cavity, with a laceration admitting the hand. Through this orifice a large amount of small intestine had been forced, forming a traumatic hernia nearly filling that side of the chest, thereby causing the tympanites, resonance, and great dyspnœa, possibly also embarrassing the heart. The pericardium was not torn.

It is possible, but not probable, that this case might have terminated differently had an early laparotomy been done, the belly washed out, all hemorrhage stopped, and the bowel reduced. The pleura would also have been found infected (as in the case below), and would have required cleansing before or after the wound of the diaphragm was closed.

CASE 2. *Stab wound of the left lung, diaphragm, and stomach; thoracolaparotomy; repair of stomach, midriff, and chest-wall; recovery after secondary cleansing of pleura.*

Paul Preschki. Entered Cook County Hospital July 22, 1906. Police stated that he stabbed himself thirty minutes before with a four-inch knife-blade.

Examination showed a stab wound, 3 cm. long, in the seventh left intercostal space, 1 cm. outside the mamillary line. Course of knife-blade downward, backward, and inward. Air rushed in and out of left pleural cavity. Patient was pale and in shock. Pulse 110; respirations 22; temperature 98.6°. Face drawn. Abdomen rigid, very tender in epigastrium. Vomited 400 c.c. of brownish fluid with sour alcoholic odor.

Operation by Dr. Andrews an hour and a quarter after admission, not quite two hours after injury. Assistants: Drs. McIntosh and Evans. Fibers of left rectus divided. Stomach found distended. When drawn away from diaphragm, sour alcoholic odor was noticed, and a small piece of food found free in serous cavity. As the organ was drawn out still further, contents began to gush out of an incised wound, 2 cm. long, in its anterior cardiac end, which could just be seen, but not drawn outside, as it was rather too near the fixed cardiac orifice. A corresponding cut was to be felt in the diaphragm. The stomach wound was accessible enough to be sutured with double line of stitches. All the extravasated fluid was sponged out. Below the colon, no soiling had occurred. The washing out was done with several gallons of hot saline solution, and the abdomen left as full as possible.

The diaphragm was difficult of suture. In fact, it was impossible to be sure that it was hermetically closed. The expedient was adopted of making a transpleural exclusion by one or two deep loop or mattress stitches. These extended through the intercostal space across into the peritoneum, through the diaphragm, where the fingers inside received the needle. This was then pushed back on the other side of the cut and through the skin. In this way the thin edge of the pleural cavity, as well as the two wounds, were occluded, the lung having receded. The rushing in of air at once ceased when these stitches were tied. I have found no record of this method being tried before. It worked very well here, as the hand inside the abdomen could guide the needle-point nicely. Similar methods have been used in liver abscesses.

It was feared that the pleura had received some of the stomach contents, and that secondary infection was probable. On the fourth and several subsequent days the left pleural cavity was found distended and several hundred cubic centimeters of turbid fluid aspirated. This did not become distinctly purulent, and, after a number of aspirations, ceased to reform.

The wounds were closed without drainage. Primary healing occurred, without great shock or serious complications, aside from the pleural infection. Next day: Pulse 124–132; respirations 34–38; temperature 101° (rectal). Third day: Pulse 144; respirations 32; temperature 100°. Fourth day: Pleural cavity dull below, tympanitic above; heart pushed to right; aspirated 130 c.c. of reddish, odorless, cloudy fluid. Sixth day: Aspirated 1,600 c.c. of same fluid. Ninth day: Aspirated 1,600 c.c. of same fluid. Thirteenth day: Aspirated 650 c.c. of dark cloudy fluid. Sixteenth day: No dullness in chest; pulse 80; temperature 99°; patient allowed to get up. Recovery rapid from this time.

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COOK COUNTY HOSPITAL

Department of Surgery

RECENT PROGRESS IN SURGERY OF THE CONJUNCTIVAL SAC

By WILLIAM E. GAMBLE, M. D., Chicago

SURGERY of the conjunctival sac, until quite recently, has been practically limited to operations for the removal of pterygium and partial symblepharon. Very extensive or total symblepharon and cicatricial orbit have been beyond the surgeon's art. The later text-books upon ophthalmic surgery give little encouragement to operative procedure under these conditions.

The importunity of patients to be relieved of these deformities has spurred each generation of ophthalmic surgeons to experiments of all sorts, which were failures, owing to improper grafting material and to imperfect coaptation of graft to wound surface. Mucous membrane from the eye of the rabbit and from the lip of the patient was tried. Inability to secure large enough grafts, and the fact that the grafts subsequently atrophied, made them impracticable.

Transportation of skin from the brow and cheek were, at best, only partially successful, and transplanting of skin in its whole thickness, known as the "Wolfe graft," has its limitations. It is too thick for use in symblepharon. It does not readily coapt itself to the wound surfaces. It now appears that it may prove to be valuable for use in cicatricial orbits. (May, 1.)

In 1893, Dr. F. C. Hotz (2) of this city called the attention of the profession to the value of the Thiersch graft in the surgery of the conjunctival sac, he having successfully used it as early as 1888 in symblepharon.

In the report of 1893, he described successful operations with this graft for symblepharon, for shrunken conjunctiva from trachoma, also the enlargement of the conjunctival sac by means of its use to sufficient extent to permit the use of an artificial eye. Since this report was made, practically all reported experimental work upon the conjunctiva has been with this graft, with varying results.

The next difficulty after securing proper grafting material was the securing of perfect coaptation of the graft to the surface of the wound. Fine sutures were used, bringing together the borders of the graft and conjunctiva, also a traction suture in the fornix, but it was found that the wrinkling of the lids displaced a greater part of the graft.

Dr. Hotz, in this same paper, also gives a suggestion regarding holding the graft in place, which has borne fruit. Having sutured the borders of the graft to the conjunctiva, he held the graft to the wound surfaces by packing the orbit with pledgets of cotton, squeezed out of salt solution, entirely filling the orbit. He sutured the lids together, after which he bandaged the eyes.

Morton (3) successfully used prosthesis as a means of holding the graft in place.

In 1897, May (4) applied the Thiersch graft to an olive-shaped porcelain shell successfully, convex surface inward, not using sutures.

In a case reported in 1900, Professor Axenfeld (5) used prosthesis in addition to sutures.

Since 1901, Dr. Hotz (6) has used plates of lead or block tin, which he fashions to suit the conjunctival wound in the individual case. He keeps on hand strips of block tin 2½ cm. wide and ½ mm. thick, having a row of holes of ½ mm. diameter bored in one edge. The technique of his operation I quote from his article, having abstracted it somewhat.

SYMBLEPHARON OF THE LOWER LID

In symblepharon of the lower lid, the lid and globe being thoroughly separated, and the cicatricial bands excised, a half-moon-shaped disk (Fig. 1) is cut from the lead strip, the perforated edge making the straight line of the half-moon. This is trimmed with the scissors and rounded off at both ends until it accurately fits into the lid-pocket. The straight edge must be even with the lid border, and the round edge must reach to the outer and inner canthi. He takes the epidermis flap from the outer surface of the patient's arm. The flap, with fine sutures, is attached to the border of the conjunctiva at the nasal and temporal

sides. The rest of the flap is spread over the lid to form a margin, after which the convex edge of the lead plate is pushed to the bottom of the newly made cul-de-sac, after which sutures are passed through the plate and lid. The bandage is kept on the eyes for two or three days; the plate is not taken off before the end of a week.

SYMBLEPHARON OF THE UPPER LID

In symblepharon of the upper lid he uses a plate which covers the whole eyeball, and reaches with its upper edge into the upper fornix and with its lower edge into the lower fornix. If the cornea is preserved, a round piece may be cut out of the plate to avoid any mechanical lesion of the cornea.

After the plate is properly molded so that when it is inserted the lids can be closed comfortably, the graft is cut, transported to the wound, and its bulbar portion is sutured to the wound edges of the ocular conjunctiva. Then the graft is spread over the bulbar wound to the fornix and over the everted lid. Now the upper edge of the plate is put on the upper fornix, and the plate is made to rest on the eyeball, while the upper lid is allowed slowly to come down upon the plate, and finally, while the plate is held in this position, the lower lid is drawn down from under the plate until its border slips over the lower edge, which then comes to rest on the lower fornix.

The lids are now closed and their free borders are united by three strong sutures. The plate is worn at least one week. After the sutures are removed, it may be taken out every day for cleansing the eye.

On February 10, 1903, Dr. H. W. Woodruff (7) reported successful operations upon three cases of symblepharon and three cases of shrunken cul-de-sac. Some of these cases were exhibited at this meeting of the Chicago Ophthalmological Society.

Dr. Woodruff used the Hotz method, and his work has stimulated American ophthalmic surgeons to try the method. His technique differs materially from that of Dr. Hotz, in that he places the graft immediately on the block-tin plate, raw surface outward, and in this way avoids the curling up of the graft, and he does not suture the graft border. This simplifies the operation greatly. He, however, makes use of sutures at the ends of the plates, passing from within, through graft and plate and lid, these sutures being tied over a roll of gauze on the outside of the lid.

In cases where both cul-de-sacs are obliterated, he also operates upon one at a time.

It has been my pleasure to see several cases that Dr. W. H. Wilder (8) has successfully operated upon, which have been reported, in which he has followed Dr. Woodruff's technique, differing in one respect: that in symblepharon of both lids he grafts both cul-de-sacs at the same operation, and uses no sutures. He also covers the plate with paraffin of a high melting-point, 130° F. or higher. (Fig. 2.) He thinks the paraffin coating lessens the mechanical irritation of the cornea where the eyeball is present. The graft adheres very well to the plate.

On February 10, 1904, Mr. A. J. A., a mine superintendent, came to me with cicatricial orbit, resulting from premature explosion of dynamite one year before, and requested me to make it possible for him to wear an artificial eye. The mutilated eye had been removed.

Before the operation, I had fashioned by Mr. L. S. Kratzmüller, from block tin, three shells of different sizes, the shape of an artificial eye, in size and form duplicates of large, medium, and small artificial eyes I furnished him. These were perforated by four holes, two near the nasal and two near the temporal side, and 6 mm. from its lower border. After making the wound cul-de-sacs, it was found that the shell measuring 26 x 21 x 11 mm. fitted the best. (Fig. 3.) Two grafts were taken from the outside of the patient's arm, for the reason that I found it difficult to get one of sufficient size. The grafts were immediately placed upon the shell, folding over the margin and bordering both the outer and inner sides to a greater width than the 6 mm., using one graft for the upper cul-de-sac and one for the lower. The two ends of a long black-silk suture, each armed with a sharp, curved needle, were passed from within outward through each pair of holes, thus passing consecutively through the bulbar graft, the shell, and the palpebral graft. Before

Fig. 1.

the introduction of the shell, these needles were passed through the lid from within outward, at such a depth as to insure drawing the border of the shell firmly into the wound cul-de-sac, after which the shell was inserted in the same manner as one inserts an artificial eye. These ligatures were tied around a roll of gauze, and the eye bandaged, and as there was little pain or discomfort, remained so for five days, when the shell was removed and it was found that both grafts had taken.

Two years and nine months later, November 23, 1906, a letter was received, of which the following is an abstract:

"*Dear Doctor:* Replying to yours of the 17th instant, I have been wearing the eye you fitted in Chicago continuously until six weeks ago, when the shell broke, when I had a new and much larger eye fitted, which I have worn satisfactorily since.

"Yours, A. J. A."

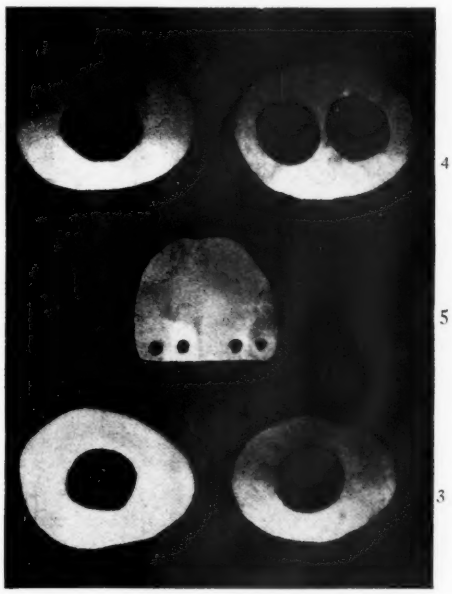

Fig. 2. (After Wilder.)

1, 3. Lead plates prepared for symblepharon operation, the cornea being present.

2. Lead plate used for restoring cul-de-sacs for prosthesis. This would be coated with paraffin.

4. Similar plate coated with paraffin.

5. Lead plate to be sewed to the lid, in the method of Hotz and Woodruff.

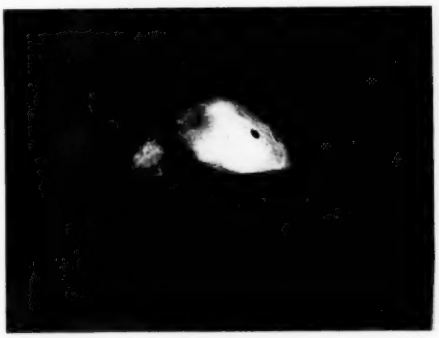

Fig. 3. Actual size.

It will be here observed that there was no attempt made to line the entire orbital cavity (as was done by Dr. May when he used the porcelain shell), but simply the cul-de-sacs in which the artificial eye was to be worn.

No great hurry is necessary in getting the graft in place; indeed, I think there is an advantage in allowing the graft to remain on the shell for a short time before introduction. It thereby adheres to the shell more firmly, lessening the danger of being curled up or otherwise displaced. Whether the shell (Fig. 3) maintains a better placed cul-de-sac for the wearer of an artificial eye than the less curved plate used (Fig. 2) remains to be seen. I have had no opportunity to compare results.

The following points in the technique should be emphasized:

General anæsthesia, as a rule, is necessary. Incision for cul-de-sacs should be kept close to lids and extend to orbital margin, all restricting bands relieved, allowing free movement of the eyeball. The skin from which the graft is taken should be rendered as aseptic as possible with green soap and water, overuse of brush to be avoided. The least hairy part of the arm is selected. A long (Woodruff), very sharp razor is used. The surface of the razor next the skin should be smeared with sterile vaseline (Hotz) to lessen friction of razor on skin.

While cutting the graft, normal salt solution should be dropped with an eye-dropper on cut edge of graft to facilitate the graft being spread out on the razor.

The graft, as has been said before, should be

at once placed upon plate and smoothed out, thereby avoiding its curling up.

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UTERINE PROLAPSE[1]

A Review of Some of the Recent Operations, with a Description of a New One

By FRANKLIN H. MARTIN, M. D., Chicago

An operation for prolapse of the uterus, to be effectual, must restore to their normal plane the two diaphragms of the pelvis, which normally lie parallel to each other and in apposition, the upper one extending from the attachment of the sacro-uterine ligaments to the rames of the pubis, a part of which is the anterior vaginal wall, the cervix, and the peritoneum covering the sacro-uterine ligaments, and the lower one (whose exposed upper surface is the posterior vaginal wall), which swing from the sides and tip of the coccyx posteriorly to the tuberosities of the ischium laterally and the rami of the pubis anteriorly.

These diaphragms, when normal, maintain the uterus at its proper plane with its cervix well back, and make impossible the descent of the bladder or the anterior vaginal wall.

The original operators sought to accomplish the support of these diaphragms and the organs depending upon them in cases of prolapse of the uterus by reinforcing the lower diaphragm only.

It was soon demonstrated that the cervix uteri, in spite of the restored perineum or the lower diaphragm, shifted forward, the uterus paralleled the vagina, and with the anterior vaginal wall and the bladder descended and finally prolapsed.

Then the long cervix was amputated, in order to eliminate this directing force of the uterus, in conjunction with the restoration of the perineum, and finally an elliptical area was removed from the redundant anterior vaginal wall in order to remedy the cystocele.

Embarrassing relapses almost invariably followed these early procedures. These repeated failures to cure a distressing difficulty led to further experiments, and the outcome of these efforts is the transference of the surgeon's dependence for success from the lower diaphragm or outlet of the genital tract to the upper diaphragm, and from the mucous surfaces covering this diaphragm to its ligamentous and muscular supports — the supports of the uterus and the arrangement of the organs above those supports.

The removal of the uterus alone demonstrated, in the recurrence of cystocele and rectocele following that procedure, with their attendant symptoms, that the uterus was but one element in the problem, and that prolapse of the vagina and cystocele would occur in spite of the removal of the uterus entire, and that the symptoms were nearly as distressing as when the uterus was part of the tissue prolapsed.

Then came the first step in the new *régime*, when Freund sought to cure uterine prolapse and the distressing cystocele by blocking the descent of the upper diaphragm by inverting the uterus posteriorly into the vagina, and attaching the exposed fundus to the anterior and posterior vaginal walls, respectively. This quite effectually effected a stoppage in the de-

[1] Read before the Chicago Gynecological Society, Friday, November 16, 1906.

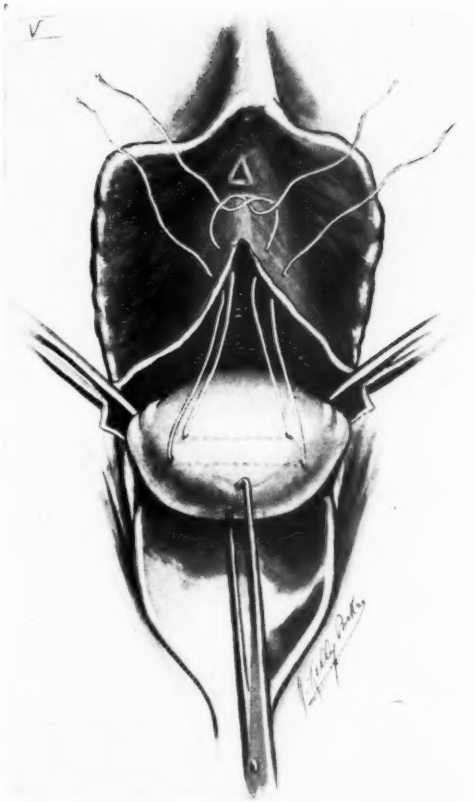


Fig. 1. First step in the Wertheim-Watkins operation.

scent by the pull exerted by the twisted broad ligaments, round ligaments, and sacrouterine ligaments, but this was all offset so effectually by the mechanical monstrosity it represented as a surgical procedure, that it only served to demonstrate the effectiveness of ligamentous support and the effectiveness of employing the uterus as a block to the descent of the bladder.

Fritsch modified this, with practically the same effect, by delivering the uterus through an anterior vaginal incision and attaching it to the anterior vaginal wall with the fundus otherwise free in the vagina.

These steps were immediately taken possession of by Wertheim and Watkins, working independently, to accomplish the same results in a more simple and at the same time a more

Fig. 2. Uniting the top of the broad ligament, the round ligaments, and the uterosacro fold to the severed portion of the stump represented by the cervix, after an abdominal hysterectomy. Looking through abdominal incision.

surgical procedure. They delivered the fundus anteriorly, after separating the bladder, and then secured it beneath the bladder, under and attached to the anterior vaginal wall (Fig. 1), thereby securing the cervix uteri high in the hollow of the sacrum, blocking the descent of the bladder with the fundus of the uterus, and obtaining strong support of the sagging center of the upper diaphragm by the strong pull exerted on the sides and top of the uterus

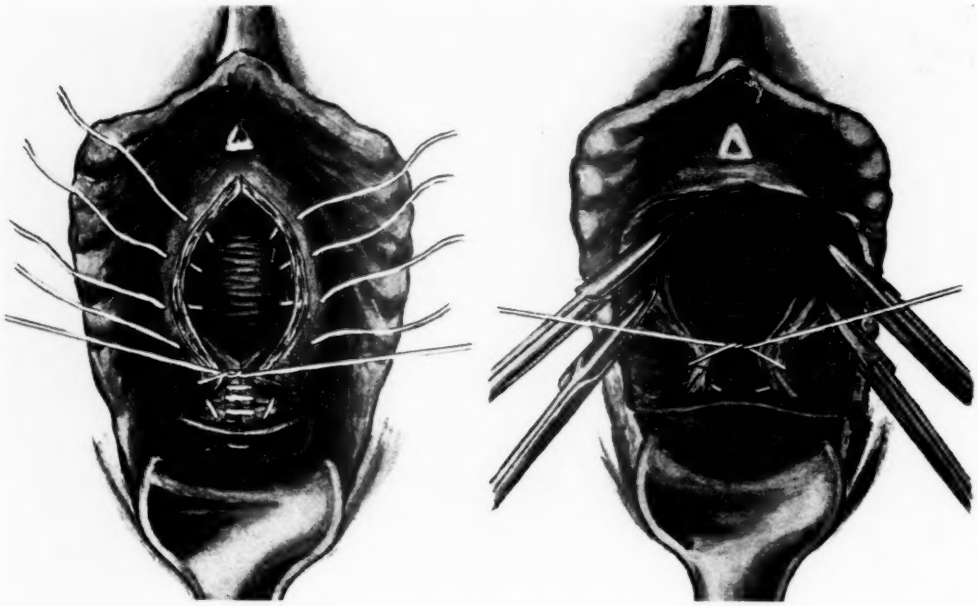
Fig. 3. Uniting the upper border of the broad ligaments, the round ligaments, and the sacrouterine fold to the edges of the top of the vagina, after a panhysterectomy.

by the twisted broad ligaments and the pulling round ligaments.

Baldy and others sutured the fundus firmly to the anterior abdominal wall, and later even advised the suturing of the cervix, after first doing an abdominal hysterectomy to the anterior abdominal parieties.

In the mean time, abdominal supravaginal hysterectomy for fibroids demonstrated that occasionally such cases, subsequent to operation, suffered from cervical and vaginal prolapse and cystocele. In seeking to avoid these results it developed that the top of the severed broad ligament at the infundibulo-pelvic fold and the severed round ligaments sutured to the cervix and together would produce a fair center support to the anterior vaginal wall and cervix, and effectually prevent prolapse of the parts. This was first systematically carried out and demonstrated clinically in this country by the Mayos. (Fig. 2.) When the cervix was removed, the ligaments were attached to the top of the vagina. (Fig. 3.) In vaginal hysterectomy, too, this procedure has gradually obtained, until now there is no longer any excuse for vaginal prolapse after either a vaginal or an abdominal hysterectomy.

Thus the evolution of this subject has about demonstrated that vaginal prolapse anteriorly, with cystocele, is dependent upon inadequate



A *B*

Fig. 4. Broad ligament operation for complete descent of the uterus.

A. The severed lower two thirds of the broad ligaments are being approximated end to end by catgut sutures. First suture in place and being drawn tight. These ends as they are drawn together are already forcing the cervix back.

As already explained, the cut ends of these ligaments, when united, pull down together with them the adjacent parametric structures, and in extensive operations also the round ligaments. Too tight tying is apt to strangulate the tissues, cause the sutures to cut out, and prevent union. No. 1 or No. 2 chromic catgut ordinarily is used. Silkworm-gut is better, but difficult to remove.

B. The severed ends of the broad ligament having been united in front of cervix, and the cystocele excised, the cut edges of the vaginal wall are being approximated from side to side. The first suture, which is being drawn tight, shows how the margins are approximated near the cervix. The other sutures show the method of union between this first suture and the others, which are introduced, but not tied. *Observe that these sutures all catch up the uterine wall, thus forcing the bladder up, so that it cannot come down again between the uterus and the vagina. This forcing up of the bladder is a very essential factor in the success of the operation.*

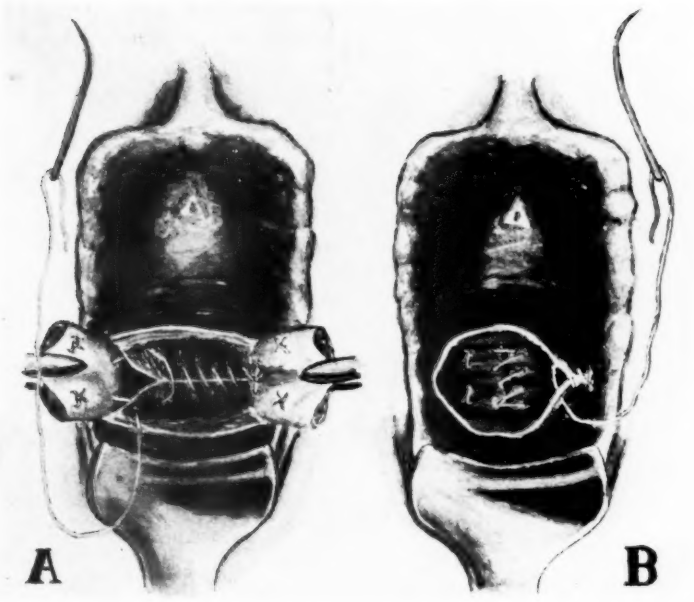


Fig. 5. Vaginal hysterectomy. Incisions have been made from the posterior vaginal fornix to the cul-de-sac of Douglas and from the anterior vaginal fornix to the uterovesical cul-de-sac. The uterine and ovarian arteries in both ligaments have been securely ligated. The left ligament has been cut away from the uterus, and is drawn to the vulva and held by forceps. (From E. C. Dudley.)

A. The last stitch of a continuous catgut suture is being taken to unite the peritoneal margins of the wound. The line of suture thus made runs from one ligament to the other, and at either end includes the ligament. Closure of the peritoneum as here shown is nearly complete.

B. The ends of the broad ligament are shown to be united in front of the peritoneum by means of a continuous catgut suture. Another suture is closing the vaginal margins of the wound by a line of union running across the upper end of the vagina from side to side. When this suture is complete, the united broad ligaments will lie between peritoneum and vaginal wall, and must necessarily sustain the rectum, vagina, and bladder on the health level.

support of the upper diaphragm by the natural ligamentous supports of the uterus, and that it is not necessary to employ the uterus as an immovable pessary for this purpose.

This, then, brings us to the next stage. Dudley separates the bladder from the uterus and anterior layer of the broad ligaments, and supports the organ and elevates it, and throws the cervix high in the hollow of the sacrum by uniting the broad ligaments in front of the uterus on the level of the internal os. (Fig. 4, *A*, *B*.)

In old women, or where the uterus is suspicious, the Mayos remove the uterus through the vagina, suture the shortened broad ligaments and the round ligaments to the anterior and posterior vaginal columns at the point of their removal from the cervix (Fig. 5, *A*, *B*), and then lengthen the posterior vaginal wall while reinforcing the perineum.

I have recently made a slight modification, in which I also utilize the ligaments of the uterus in supporting the upper diaphragm.

The operation is applicable to women who have passed the child-bearing period, and consequently in whom there is no objection to the removal of the uterus.

Briefly, the operation is as follows:

1. A T-shaped incision is made on the anterior vaginal wall, and the bladder is thoroughly separated and the peritoneum entered as in the Wertheim method. (Fig. 6.)

2. (*a*) The uterus is delivered through this anterior incision and the broad ligaments at the infundibuliform fold, and the round ligaments secured with strong crushing-forceps, and the

Fig. 6. Anterior vaginal wall severed from the cervix by semilunar incision — the anterior vaginal wall incised in the median line from the cervix to within one half to one inch of the meatus urinarius; with the finger covered by gauze, the bladder is separated from the uterus by blunt dissection.

Reproduced from Watkins, SURGERY, GYNECOLOGY AND OBSTETRICS, June, 1906.

uterus freed from them on the left side. (*b*) The uterine artery is tied on the same side, the body of the uterus is severed from the cervix on a level with the internal os, the uterine artery secured on the right side, and while the anteverted cervix is secured with vulsella attached to its severed surface, the uterus is delivered and the broad ligament and round ligament are secured as on the left side, after which the body of the uterus is cut away. (Fig. 7.)

3. (*a*) The upper portion of each broad ligament is now ligated and sutured securely across the severed portion of the cervix and to each other. (*b*) The clamped round ligaments are each ligated and also sutured to the top of the cervix. (*c*) Finally, the peritoneum posterior to the cervix is secured, together with the two folds representing the sacrouterine ligaments, and sutured over and to the severed portion of the cervix in such a manner as to cover it with peritoneum, and also make taut the sacrouterine ligaments. (Fig. 8.) (*d*) After covering all exposed portions of the abdominal surface of the cervix with peritoneum, the cervix is released, when it is immediately drawn as high in the pelvis as the vaginal walls will allow it to go, by the pull of the three sets of shortened ligaments attached to it. (*e*) The incision in the anterior vaginal wall is closed. (Fig. 9.)

4. (*a*) The vaginal outlet is reinforced by a flap-splitting perineorrhaphy, done in such a manner as to slide the whole posterior vaginal wall in the direction of the cervix, and thus insure against interference with a maximum elevation of the cervix and consequent elongation of the vagina. (Fig. 10.) (*b*) If the anterior vaginal wall is excessively redundant, the tissue on either side of the longitudinal incision in the anterior vaginal wall is trimmed so that the wall will be narrowed upon closing the incision.

Hence we observe that the evolution of this

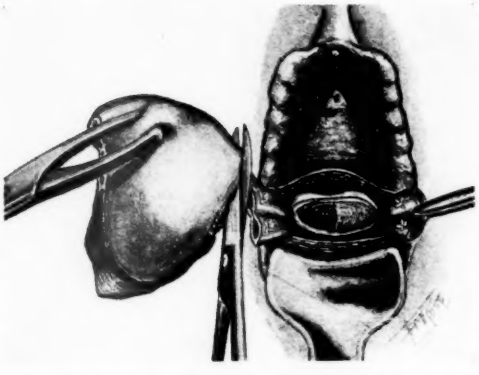


Fig. 7. Vaginal hysterectomy. Cervix intact after vaginal hysterectomy. Broad, round, and uterosacro ligaments before they are united to the top of the cervix. Modified from Dudley's drawings.

operative treatment for prolapse of the uterus has caused less stress to be laid on an attempt to support the prolapsed organs by narrowing the outlet of the pelvis and the vaginal column, and correspondingly greater stress and recognition have been given to the actual supports of the upper diaphragm represented in the important supports of the uterus, the bladder, and the vaginal column.

The requirements, then, for a serviceable operation are:

1. That the supporting diaphragm of the uterus and bladder be made taut by elevating and maintaining the cervix uteri or the upper end of the vagina high in the hollow of the sacrum, opposite the junction of the third and fourth sacral vertebræ.

2. This may be accomplished: (*a*) By anteverting the uterus extremely, and anchoring the fundus beneath the bladder and above the anterior vaginal wall, and thus obtaining a strong uplift of the uterus through the intervention of its twisted ligaments, and at the same time forcing the cervix and upper end of the vagina high and far back in the pelvis. (*b*) By reefing or severing the broad and round ligaments in front of the uterus and thus lengthening the vagina by forcing the cervix backward, at the same time getting a strong supporting upward pull on the diaphragm from the effect of the shortened ligaments. (*c*) By attaching to the top of the vaginal tube and to each other the severed ends of the broad ligaments and the

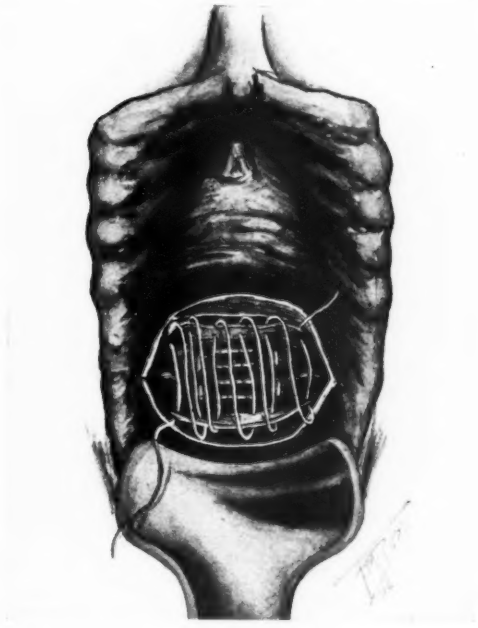


Fig. 8. Similar to Fig. 5, except that ligaments, including the sacrouterine ligaments, are attached to the top of the severed cervix. The sacrouterine ligaments and the round ligaments sewed to the cut surface of the cervix, and sutures applied to anterior and posterior peritoneal edges of severed cervix, preparatory to covering stump and ligaments with peritoneum.

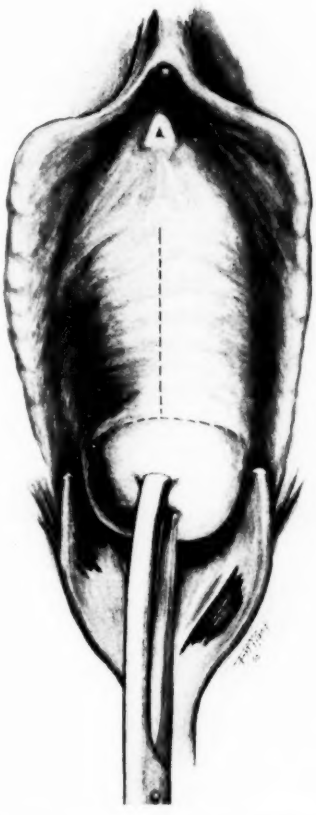


Fig. 9. The cervix released and the incision in the anterior vaginal wall sewed with interrupted catgut suture. Operation completed.

Reproduced from Watkins, SURGERY, GYNECOLOGY AND OBSTETRICS, June, 1906.

Fig. 10. Tait flap-splitting perineorraphy. Showing method of sliding the posterior vaginal wall cervixward, and method of retaining same when the muscles of the perineum are united.

round ligaments after a vaginal panhysterectomy. (*d*) By attaching to the cervix, after a vaginal hysterectomy done through the anterior vaginal wall, the severed broad ligaments, the sacrouterine ligaments, and the round ligaments, thus elevating and carrying well back the cervix and maintaining the diaphragm without sag by the strong uplift of the shortened ligaments. (*e*) As an important adjunct to the ligamentous support accomplished by any of the above procedures, the rectovaginal septum should be thoroughly repaired and the posterior vaginal wall lengthened by sliding upwards its lower end. If the anterior vaginal wall is particularly redundant, an elliptical fold should be removed from it and the edges united. Care should be observed not to shorten the vaginal wall. (*f*) These patients should remain in the recumbent position for a period of at least two weeks following the operation. The patient should also be instructed to avoid unusual exertion for at least three months. The bowels should be kept free, and hot normal salt vaginal douches should be employed night and morning for a period of six months.

COOK COUNTY HOSPITAL
Department of Surgery

THE TERMINATIONS AND THE TREATMENT OF EXTRAUTERINE PREGNANCY

WITH A REPORT OF THIRTY-TWO CASES TREATED AT THE COOK COUNTY HOSPITAL

BY AIMÉ PAUL HEINECK, M.D., CHICAGO

ECTOPIC gestation is of far more frequent occurrence than we believe. The morbidity and the mortality of this condition are largely due to our inability to recognize it timely. We can more knowingly discuss the treatment of extrauterine pregnancy after we have become familiar with the possible terminations of this condition. What can nature, unassisted, do for our patient? What can surgical aid accomplish? This is the motive of this paper.

The possible terminations of extrauterine pregnancy are the following:

1. The pregnancy may go to term, and a living child be delivered, through channels created by the surgeon (1). This is an exceptional occurrence. Well-authenticated cases, however, are reported. In connection with this termination, we must state that extrauterine children frequently die in the first few days of life; many of them have lived only a few hours. They are frequently the subjects of deformity. The operation necessitating their removal from the maternal organism may prove fatal to them. It may prove fatal to the mother, either immediately, from surgical shock or from excessive hemorrhage; or secondarily, from toxæmia, septicæmia, or pyæmia. That ectopic gestation may terminate in a living and viable child (development of the child having taken place either in the peritoneal cavity or between the folds of the broad ligament) applies as much to ovarian as to tubal pregnancy. It, however, has been much more frequently observed as a sequence of tubal gestation. That an ovarian pregnancy can go to term is attested by such authorities as Sänger, Küstner, Spiegelberg, Leopold, Gottschalk, and Herzfeld.

2. The child may go to term, remain undelivered, and die, persisting in the maternal organism. Changes may take place in the fœtus and in the surrounding tissues, as described in the next paragraph.

3. The fœtus may die at term or previous to term. Fœtuses that die at an advanced state of development cannot be absorbed. The death of the fœtus does not imply freedom from danger to the mother. Degenerative changes usually begin in the fœtus after its death. The fœtus may:

A. Putrefy. The absorption of the products of dissolution will cause loss of appetite, emaciation, a low grade of sepsis, with hectic, loss of strength, and other symptoms.

B. May become septic: (*a*) From communication with neighboring organs, as in Harris's case (2); (*b*) From contiguity with neighboring organs, in which the fœtal sac, which had formerly given a dull note on percussion, suddenly gave a tympanitic note, showing that the fœtal sac contained air that had entered from a perforation of the intestines. If a fœtal cyst become septic, the woman may perish, either directly from inflammatory complications or from the absorption of putrid material, resulting from decay.

C. May continue to persist in a cartilaginous state (3).

D. May become converted into a friable fatty substance, then constituting what is known as an adipocere.

E. A lithopædion may form, of which three chief forms may be distinguished (Kuchenmeister). "In the first, the mummified fœtus may be shelled out easily from the calcified membranes (lithocelyphos). In the second the fœtus becomes adherent to the membranes at different points, which become calcified, while the other portions become mummified (lithocelyphopædion). In the third form, the

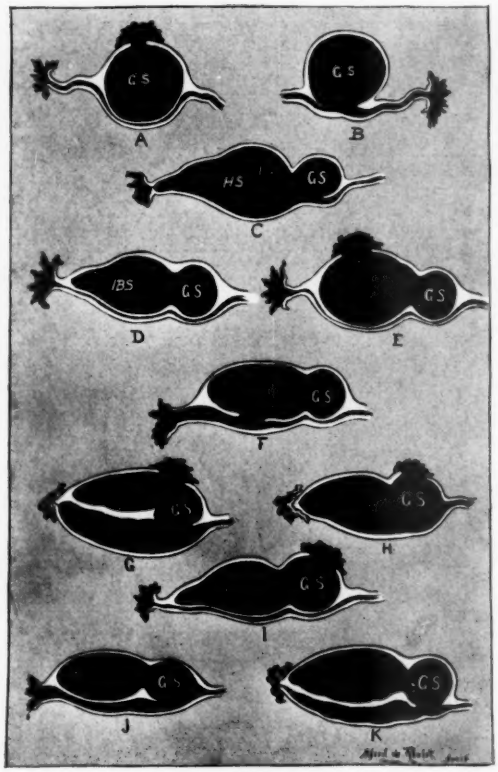


Fig. 1.

A. Extratubal rupture of gestation-sac. Escape of blood into peritoneal cavity.

B. Intratubal rupture, with escape of blood into peritoneal cavity through ostium abdominale of Fallopian tube.

C. Intratubal rupture, with retention. Hæmatosalpinx.

D. Intramural rupture. A layer of muscular tissue intervenes between the blood-extravasate and lumen of tube.

E. Intramural rupture, with blood-sac opening into peritoneum.

F. Intramural rupture, with blood-sac opening into lumen of tube.

G. Combined intratubal and extratubal and intramural rupture.

H. Combined intratubal and extratubal rupture.

I. Combined intramural and extratubal rupture.

J. Combined intramural and intratubal rupture, with escape of blood into peritoneal cavity.

K. Combined intramural and intratubal rupture, with retention of blood into lumen of tube.

GS. Gestation-sac. *HS*. Hæmatosalpinx. *IBB*. Intramural blood-sac.

fœtus is discharged through the rupture of the membranes into the peritoneal cavity, and later become incrusted with lime salts (lithopædion)."[1]

[1] Zeigler's Pathology.

In extraperitoneal development there is a lessened tendency to the development of lithopædia. W. H. Fales[2] reports a case in which a lithopædion had been retained in the abdominal cavity for thirty years. A. F. Currier[3] removed, by abdominal incision, the remains of an extrauterine fœtation of fourteen years' duration.

F. The fœtus may become encysted by a connective-tissue membrane, and remain for a time or permanently quiescent, doing no harm to the patient beyond being a mechanical inconvenience (Playfair). However, a woman is never free from danger while she is carrying an encysted child.

G. The fœtal cyst may mechanically interfere with a subsequent intrauterine pregnancy; it may have to be removed to allow the intrauterine pregnancy to go to term, as in Vignard's case (4). The dead extrauterine fœtus was well tolerated for five months; then, owing to a developing intrauterine pregnancy, it became a source of greater and greater discomfort, and finally had to be removed during the fourth month of uterine gestation.

H. It may cause symptoms of irritation of contiguous organs, rectal tenesmus, vesical tenesmus, painful micturition, etc. It may cause pressure symptoms; for instance, intestinal obstruction by compressing the intestines, urinary retention by compressing the bladder or ureters. It may cause various displacements of the uterus. It may cause errors in diagnosis. Giles and Maclean report, in *Transactions Obstetrical Society of London*, 1898, two cases of tubal gestation; one causing chronic intestinal obstruction, the other simulating retroversion of the gravid uterus.

After death the liquor amnii is absorbed. No more is secreted. The cyst shrinks, and the product of conception may remain quiescent in the maternal abdomen. Full-term fœtuses have frequently been found in the abdominal cavity at the autopsy-table and on the operating-table. Nevertheless, the ova that develop to term or near to term are clinical rareties.

I. After the death of the fœtus, the gestation-sac may be considered as a cyst — a fœtal cyst.

[2] Boston Medical and Surgical Journal, 1887, vol. cxvii, p. 131.

[3] Annals of Gynecology and Pediatrics, Boston, 1897–98, vol. xi, p. 732.

The walls may, and frequently do, become adherent to surrounding organs or to surrounding tissues, viz., bladder, vagina, intestinal canal, or abdominal wall, by either or by several of which channels the cyst may eventually, completely or incompletely, eliminate its decomposing contents; hence the cyst may communicate: (*a*) With the bowel, by one or several openings (5). (*b*) May open into the vagina (6); (*c*) May open into the urinary bladder. When the cyst ruptures into the urinary bladder, the vesical symptoms are caused not only by the irritating character of the fluids which find their way into this organ, but likewise by the large number of bones, any one of which may become the nucleus of a stone. Guisy (7) removed a three months' fœtus from the urinary bladder. Joseph Bossuet (8) reports a case in which the fœtus was mostly in the urinary bladder and partly in the rectum. It was covered with calcareous matter. Haggard (8) reports a case in which he removed by a vaginal cystotomy the skeleton of an ectopic fœtus that had ulcerated into the bladder. Hue [4] removed from the bladder of a woman, aged 62, the cranial bones of an extrauterine fœtus; from another patient, aged 64, who had had several miscarriages, he removed the upper limb of a four or five months' old fœtus; the rest was in a fœtal sac which communicated with the bladder. (*d*) May open into the rectum and the bones be expelled through the anus (9). In a case reported by G. Lemonnier,[5] the extrauterine fœtus, remaining in the maternal organism 24 years, was finally expelled per rectum. The patient had two normal pregnancies and deliveries subsequent to her extrauterine conception. (*e*) May open through the abdominal wall, as in the case reported by Blugnies-Corbeau.[6]

"After three years of ill health, the fœtal sac gave birth to an abscess which developed in the gluteal region, the fragments of a fœtal skeleton came away through it, and a sinus was left, which was slow to heal; a second abscess opened in the same region on the opposite side, the third in the hypogastrium, and a fourth in the perineum. This last fistulous track discharged one of the scapulæ. It took five months in passing through the perineal structures. After many years of suffering, the patient was restored to perfect health. This does not speak volumes in favor of the expectant or rather non-operative treatment of extrauterine pregnancy."

[4] Revue de Chirurgie, Paris, Aug., 1890.
[5] Bulletins et Mém. de la Soc. Obst. et Gynec. de Paris, 1898.
[6] Quoted from the British American Journal, May 21, 1887.

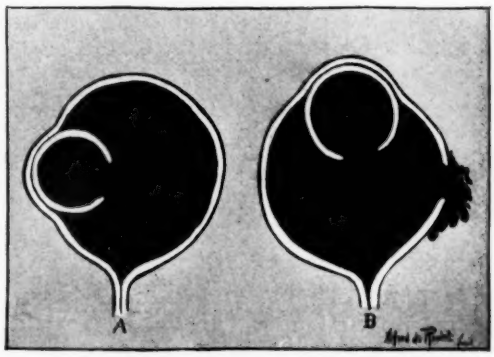


Fig. 2.

A. Intraligamentous rupture of gestation-sac.
B. Intraligamentous rupture of gestation-sac, and rupture of intraligamentous blood-sac into peritoneum.

J. The fœtal cyst may become adherent to and rupture into the uterus, as in Bertino's case (10). In this case, after the death of the fœtus, the fœtal sac became adherent to and ruptured into the uterus, leading to the escape of bony fragments into the vagina. It then became adherent to the abdominal wall and ulcerated through the umbilical region, leading to the escape at this point of a fœtid yellowish liquid and of fragments of necrosed tissues. Eighteen months after the death of the fœtus, a laparotomy was performed. The aperture of communication between the uterus and the fœtal sac was demonstrated, and the remaining bones of the skeleton were removed from the fœtal sac at the time of operation.

K. The fœtal cyst may open by more than one channel in the same patient. In Fenwick's case (11), the sac, which was of some years' duration, contained a macerated fœtus; by one fistula it communicated with the bowel, and by another fistula it communicated with the bladder.

L. It may rupture into a cyst contained in the abdominal cavity, as in Urbain's (12) case, in which a left tubal gestation-sac ruptured in a cyst of the right ovary.

The following various channels of elimina-

tion, and the frequency of same and the mortality noted, were observed by Mattei, Parry, and Puech:

Channels of Elimination	Observed by	Number of Cases	Died
Abdominal walls	Mattei	21	1
	Puech	28	4
	Parry	40	10
Intestinal canal	Mattei	30	19
	Puech	69	4
	Parry	65	24
Vagina	Mattei	7	2
	Puech	23	5
	Parry	12	5
Bladder	Mattei	8	2
	Puech	17	3
	Parry	9	5

4. Rupture (13) of the gestation-sac may take place before or after the death of the fœtus. J. B. Sutton says that primary rupture takes place in the majority of cases between the third and the tenth week. Rupture is one of the terminations of tubal pregnancy, be the pregnancy tubo-uterine, intramural, isthmic, or ampullary, etc. Ovarian pregnancies are subject to the same accident. "A rupture, especially in tubal pregnancy, whatever may be its form, generally occurs before the end of the fourth month. In 26 of the cases, this accident supervened at the end of the second month. After this, there appears to be a period of comparative safety, which lasts until the end of the third month, at which time there are thirty cases of rupture. After the end of the fourth month, it is much rarer, but it may occur up to the end of gestation, or even after it in rare cases. The period during which life was prolonged is mentioned in 113 of the 174 deaths from rupture. Of these, 39 died in 10 hours or less; 29 lived between 18 and 48 hours after rupture. At the end of 48 hours, only 15, or a little more than 13 per cent of the whole number, were alive" (12). Rupture may occur of the primary or of the secondary gestation-sac. The gestation may be arrested by this accident, or it may continue uninterrupted, though changed in type. The rupture is associated with hemorrhage, slight or profuse, circumscribed or diffuse, belonging to one of the three following types, or to a combination of two or of all these types: (*a*) Extratubal; (*b*) Intratubal; (*c*) Intramural. As mentioned previously, the rupture may lead to the cessation of the gestation; it may not interfere with its continuance. If the amniotic sac be ruptured and there be an outflow of the amniotic fluid, gestation will come to an end. I have come across only one case in the literature of a living extrauterine child on which, at the time of operation, no amniotic sac could be discovered. In the early stages, the ovum will be absorbed; the younger the ovum, the less prolonged will be the process of absorption. An ovum in a very advanced stage of development will not be absorbed, and thus remains, a source of danger. Necrosis of the sac and of vessels supplying it can cause a fatal termination of the host.

Extratubal rupture may occur into the peritoneal cavity; if the ovum does not perish, the pregnancy will be continued as a tuboperitoneal or peritoneal pregnancy. Extratubal rupture may also take place between the folds of the broad ligament. Pregnancy may here continue as an intraligamentary pregnancy, called by some authors a tuboabdominal pregnancy. Intraligamentary pregnancy is far more infrequent than peritoneal pregnancy. Otto Küstner, who, from October, 1893, to October, 1898, operated on 107 cases of ectopic gestation, never once in his series met a tuboabdominal or intraligamentary pregnancy. The primary rupture may be between the folds of the broad ligament, and the secondary rupture take place into the peritoneal cavity. An intramural rupture may secondarily lead to an intratubal or extratubal rupture. In intramural rupture there is a thin layer of muscle-tissue and peritoneum which separates the blood-sac from the peritoneal cavity. It may be compared to the condition that obtains when a saccular aneurysm ruptures and the blood escapes interstitially. Intratubal rupture may, if the abdominal opening of the tube be occluded, lead to an accumulation of blood in the cavity of the tube, viz., hæmatosalpinx. If the abdominal end of the tube be not occluded, the blood passes out of the tube into the peritoneal cavity, giving us a pelvic hæmatocele or a hæmoperitoneum. The ovum, continuing to develop in the tube, may secondarily rupture, either into the peritoneal cavity or between the folds of the

broad ligament, and gestation therein continue. If one variety of rupture fail to relieve the tension, the gestation-sac will probably rupture in another direction. The ovum may be carried out of the tube by the intratubal hemorrhage, giving us the condition of tubal abortion.

Far more frequent, however, and of far more immediate danger, and usually requiring immediate surgical interference, is the hemorrhage that attends and follows rupture. This rupture may be due: 1. To hemorrhage between the chorion and the tubal mucous membrane; 2. To hemorrhages from the tubochorionic vessels into the tubal sac, causing overdistention of the latter; 3. To the cyst-wall being thinned and weakened by the chorionic villi; 4. To absence or feeble development of the decidua reflexa; 5. The ovum may rupture from a traumatism, be it ever so slight. As a general proposition, we can assert that the trophoblasts are the causative agents of early rupture; mechanical causes, those of late rupture, as undue violence in examining. These trophoblasts have an erosive action upon the various layers of the tubal wall. They exert their destructive action upon the vascular tissues, as well as upon muscular tissue. Ruptures of ovarian gestation-sacs, like tubal ruptures, usually occur before the third month. Rupture takes place at the point of least resistance, which is either the placental site of the future placental site, for the chorionic villi remain longest at this point. In the intramural ruptures, the blood extravasation is separated from the lumen of the tube by a layer of muscle tissue, more or less marked.

We then have as a most alarming complication of tubal or ovarian ruptures, hemorrhages, small or large. We must keep in mind that the amount of blood discharged bears no relation to the extent of the rupture. Some of the most severe hemorrhages occur from orifices that are very small. The rupture may be punctiform in size; may be a large tear; may be almost a complete rending of the tube. If the rupture be into the peritoneal cavity, we may have the formation of a hæmatocele, called by some hæmoperitoneum, that is, a circumscribed collection of blood located in the pelvis, and separated from the general peritoneal cavity by firm adhesions and small-celled infiltration, or we may have a flooding of the peritoneal cavity, which will cause the patient's death unless the hemorrhage be arrested. There may be one severe and perhaps fatal intraperitoneal hemorrhage, or there may be recurring hemorrhages, causing maternal death. The prognosis of an encysted peritoneal or of a diffuse intraperitoneal hemorrhage is the same, whether the cause be a ruptured tubal or a ruptured ovarian gestation-sac. The outcome is dependent on the extent, duration, and continuousness of the hemorrhage, not upon its source. Retrouterine hæmatoceles are usually due to extrauterine pregnancy; not uncommonly, villi, or even an embryo, may be demonstrated in them. The uterus may become enveloped by this bloody mass, producing what is known as a circumuterine hæmatocele. Intraperitoneal hemorrhages due to a ruptured ectopic gestation-sac have the same gravity as intra-abdominal hemorrhages due to other causes. The signs and symptoms of acute anæmia are quickly produced.

If the extratubal rupture be between the folds of the broad ligament, the extravasation and accumulation of blood therein will separate these folds, and a pelvic hæmatoma will be produced. This hæmatoma is almost invariably one-sided, and, needless to say, is on the side of the rupture. In some cases, however, it may dissect forward between the uterus and bladder, or backward around the uterus beneath the peritoneum and extend to the opposite side. In those cases where the tension within the hæmatoma is sufficiently great, rupture may take place into the peritoneal cavity, giving us the combined condition of both intraperitoneal and extraperitoneal hemorrhages. The same may occur in a hæmatosalpinx. The excessive tension may lead to extratubal rupture into the peritoneal cavity, or between the folds of the broad ligament, or in both directions. The hemorrhage associated with the rupture of a tubal or an ovarian gestation-sac may, in itself, prove fatal, may lead to formation of a pelvic hæmatoma, or to the formation of a pelvic hæmatocele. These encysted blood collections — hæmatoma or hæmatoceles — which may be and frequently are partially or completely absorbed, may persist as fibrous bands or masses, may become infected and thus be the seat of a suppurative

inflammation. (We have no certain means at our command enabling us to know in every case, before operation, whether rupture has taken place in the peritoneal cavity or between the folds of the broad ligament.) If the inflammation remain circumscribed, an abscess is formed. If the inflammation spreads to, or if the abscess bursts into, the peritoneal cavity, a circumscribed or diffuse suppurative peritonitis results. If the inflammation extends to the retroperitoneal connective tissues, there will be a cellulitis, with all its accompanying dangers. These internal hemorrhages attending rupture far exceed in importance and copiousness the uterine hemorrhages that very frequently occur in intrauterine pregnancy. These latter are from the decidua that forms in the uterus in all cases of extrauterine pregnancy. (J. Veit.) They are of some diagnostic value, but are insignificant when compared with hemorrhages that come from the placental side. The expulsion of the uterine decidua does not imply the death of the extrauterine fœtus.

We must keep in mind that hemorrhage, internal or external, at some period, occurs in all cases of extrauterine pregnancy. The symptoms of shock and loss of blood are much greater in intraperitoneal hemorrhage than in the intraligamentary form. The hemorrhage continues in the former, but necessarily ceases in the latter as soon as the pressure of the extravasated blood exceeds the intravascular pressure. Hemorrhage into the peritoneal cavity, being a hemorrhage into a practically unlimited space, is bound to be more formidable than the intraligamentary form, because less likely to be spontaneously arrested than a hemorrhage into connective tissue.

The migration of the ovum into the abdominal cavity, through the ostium abdominale, is known as tubal abortion. (Bland Sutton.) We may have tubal abortion. Tubal abortion may also lead to hæmatosalpinx. Usually, however, the blood escapes freely through the ostium abdominale into the cul-de-sac of Douglas, and may become encysted there, or it may escape into the general peritoneal cavity. Tubal abortion may be due:

1. To contractions taking place in the tube, whereby separation of the placenta, or hemorrhages into its substance, is provoked.

2. To detachment of the ovum, by frequently repeated small hemorrhages. Extraovulary hemorrhages cause a detachment of the ovum; at times, a bursting of the capsule at the level of its reflexa.

3. To hemorrhages taking place in the muscular fibers of the tube.

4. To the ovum being carried out of the tube by the escape of blood from intratubal hemorrhages.

5. To intraovulary hemorrhages. The intraovulary hemorrhages cause the death of the ovum. The ovum being dead, the villi atrophy; as they cease to occlude the placental sinuses, we have hemorrhages, which are the consequence and not the cause of ovular death.

In the early stages, abortion and rupture are due directly to the destructive action of the trophoblast on the peritoneal and mucous surface. They can be indirectly due to increase of tension caused by hemorrhages from vessels, the walls of which have been destroyed by the ectoblastic cells. Tubal abortion may be complete, or may be incomplete. In the former, there is usually one attack of pain and weakness. In the incomplete form, we have repeated attacks of weakness. The abortion, if the amniotic sac remains intact, and if the ovum resists absorption, leads to a tuboperitoneal or peritoneal pregnancy. If the villi or placental attachments are destroyed, the ovum, being unable to form secondary attachments to other structures, dies. The rupture of the amnion in the early months leads to the death of the embryo or fœtus.

Tubal abortion occurs almost always in the early months. Vidal claims that complete tubal abortion after the second month is impossible. Martin (Berlin) has, however, seen it occur at the ninth month. This late occurrence of abortion is rare. (Bazy: *Progres. Medical*, 1906.) The following are some of the explanations given for the frequent occurrence of tubal abortion during the early period of tubal gestation:

1. The union between the placental villi and the tubal mucosa is not very intimate at that period; hence a very small extravasation of blood suffices to disturb their integrity.

2. The tube is at that period not much distended; hence its musculature opposes greater resistance to rupture.

3. The tubal ostium abdominale is usually open.

4. Its muscular layers can furnish contractions powerful enough to chase the ovum and blood extravasate out of the tubal lumen into the abdominal cavity.

TREATMENT

We assert without the least hesitancy that this is as surely a surgical disease as appendicitis, and though, as in that disease, a clinical cure may at times be obtained by non-operative measures, it is not common for that clinical cure to be an anatomical one. We maintain with equal emphasis that that treatment is the most conservative which saves the most human lives. In these cases, the viability of the child should not be considered, except as it endangers the life of the mother. We must look on the extrauterine fœtus as a parasite, as a malignant new growth. We must be prepared to destroy the fœtus to save the mother. We must, from the standpoint of treatment, consider: 1. If the patient will live — (*a*) If she be abandoned to nature; (*b*) If she be operated on; and 2. If the dangers incidental to opening the peritoneal cavity are less than those of rupture of the gestation-sac. Unless artificially relieved, an extrauterine pregnancy always terminates fatally to the child, and is frequently fatal to the mother.

Nature's tedious methods of relief, and the many dangers to which the woman is obviously exposed during its occurrence, justify surgical interference. Even the absorption of large uninfected collections of blood is far more prolonged than post-operative convalescence. A. Martin has shown that 36.9 per cent of 265 cases of extrauterine pregnancy recovered under an expectant plan of treatment, but he has also shown that 76.7 per cent out of 515 cases recovered under operative treatment. According to Martin, internal hemorrhage consequent to tubal rupture has a maternal mortality of 83.1 per cent. According to Costan, the maternal mortality is 85.8 per cent. Of the 174 cases of rupture reported by Parry, none recovered. When operated on, according to Choyan, the percentage of maternal recoveries is 84.4 per cent. Newell (*Boston City Hospital Reports*) reports 69 cases of ectopic gestation treated operatively; of these, 43 were operated on by the abdominal route, and of these, 35 recovered. The others were operated on either by the vaginal route or by both vaginal and abdominal routes. There were seven deaths — one of cerebral thrombosis, four of general peritonitis, two of shock, one of hemorrhage, and one of pulmonary embolism. Cassius C. Rogers reports seven operations, with seven recoveries (*Medicine*, June, 1905).

In the hands of the average operator, the only dangers to which the operation subjects the patient are sepsis, hemorrhage, and shock. The first can be avoided, the second can be largely controlled, and the third can be minimized and almost always overcome.

Some operators make use of the terms "primary laparotomy" and "secondary laparotomy." In the former, the operation is performed during the life of the fœtus. It is in accord with the theory and practice of modern surgery. It attacks tissues while they are healthy, in preference to awaiting nature's blind efforts to improve conditions. Secondary laparotomy is the operation performed after the death of the fœtus.

Simple measures, such as puncture of the fœtal cyst, have caused death of the mother from secondary hemorrhage, from septicæmia. This measure has been abandoned, because the discharge of the liquor amnii does not always cause the death of the fœtus. The method was dangerous. It is inefficient, and we know that even after its death the fœtus, as long as it remains in the maternal organism, can at any time become a source of danger to the mother. The injection of narcotic substances into the cyst cavity so as to poison the fœtus, the attempts to destroy the fœtus by the application of electricity, have all deservedly been cast aside. They have fallen into disrepute because of their uncertainty. They, at times, secured the death of the fœtus, but they did not restore the mother to health, or protect her from morbid, and too often fatal, complications. The only treatment which offers the mother positive assurance of complete restoration to health is the operative treatment. W. J. McDonald says: "Time forbids entering into the discussion of the injec-

tion of narcotics into the gestation-sac to induce the death of the fœtus, as well as that of the application of electricity, in the treatment of extrauterine prognancy. These plans have been repeatedly discussed, and so universally condemned, that nothing is to be gained by further consideration." Grandin and Jarman, in discussing operative treatment, say: "The almost absolute mortality-rate of the past has been converted into the almost certain recovery-rate of the present."

The diagnosis of ectopic gestation is in itself an imperative indication for operation. Lives can be saved by accurate diagnosis, prompt decision, and skillful operation. In the absence of urgent symptoms, we still have an operation of necessity; we can proceed deliberately and select our place and time of operation, giving our patient the benefits of all the refinements of an aseptic and an antiseptic surgical preparation, and endeavor to operate under the best hygienic conditions. If rupture has occurred, and progressive hemorrhage has taken or is taking place, we have an emergency operation. You cannot see through the abdominal wall to determine whether the hemorrhage has ceased or continues.

Your first indication is to stop the hemorrhage. This indication is urgent. Hypodermic medication will not accomplish it. To stop this hemorrhage, you cannot depend upon the coagulability of the blood; upon the lessened force of cardiac action; upon such agents as heat, cold, styptics, and the like. You must open the abdomen; you must stop the hemorrhage at its source; you must ligate bleeding-points with aseptic absorbable ligature material, if you have it at hand; with antiseptic non-absorbable ligature material, if the former be not at hand.

Even in the absence of urgent symptoms, you must not long delay operation, because as long as the embryo or fœtus lives, the placenta increases daily in size, in vascularity, and in difficulty of removal. Furthermore, every day, the increasing size of the child and of the placenta adds to the danger of secondary rupture.

J. Veit says: "Operate in all cases of extrauterine pregnancy, whatever may be the age of the embryo or fœtus." He also lays special emphasis upon this indication: "Operate immediately in all cases in which there is a suppuration of the fœtal sac, and drain freely."

My views may be considered extreme. They are, however, the result of my experience, and of the beneficent results which have uniformly attended their observance. I do not say all the indications that call for a cessation of an intrauterine gestation are valid indications for the cessation of an extrauterine pregnancy. I go further than that; I believe and declare that a diagnosis of extrauterine pregnancy is in itself an ample cause for operation. I also must add that ectopic gestation is an illness; and the sooner the illness is brought to an end, the better. The woman is in constant danger of primary rupture, of secondary rupture. The most successful operations are those performed early upon unruptured ectopic gestation sacs. Operation is far more likely to be successful when performed early, than if performance be delayed until septicæmia and suppuration of the sac have occurred. The late operations, though not as easy of execution as operations performed in the early period of pregnancy, have, with the advent of aseptic surgery and increase in operative dexterity, become less dangerous than they were in former years. "The early operation is technically no more difficult than the extirpation of the normal non-adherent uterine appendages; the operation toward the end of pregnancy, by which we mean the total removal of the ovum and its contents, is always formidable, and often technically an absolute impossibility." (C. Fenger.)

The coexistence of intrauterine pregnancy is not a contraindication. E. G. Zeinke (15) collected 88 cases in which both intrauterine and extrauterine pregnancy existed.

If done skillfully, the progress of uterine gestation is not interfered with by severe operative interference. In these cases the ectopic sac must be removed; the intrauterine gestation must not be molested. There is abundant evidence that the removal of tumors of the uterus, broad ligament, and ovaries, or any other abdominal growth, can be removed during the pregnant state without jeopardizing the patient's life, any more than in the non-pregnant state. The same applies to the removal of the ectopic gestation-sacs.

Vineberg (16) reports 53 cases of ectopic gestation on which he operated. In 50 he employed the abdominal route; in 3, the vaginal route only. Only one death in this series. Schauta's statistics of 123 operations, in unselected cases, give a mortality of 3 (0.7 per cent); 121 cases treated expectantly, that is, subjected to non-operative treatment, give a mortality of 86.9 per cent. C. C. Barrows (*Medical Record*, vol. lxviii, p. 880), in 79 cases, operated by the abdominal route 77 times, by the vaginal route 2 times. No deaths.

The condition of ectopic gestation is, no doubt, at times, very difficult to diagnose. Often, only a probable diagnosis can be made. But those conditions which simulate extrauterine pregnancy are conditions the relief of which can be obtained only by operative measures. We must keep in mind that pregnancy, intrauterine and extrauterine, is not the only condition that causes enlargement, swelling, and softening of the uterus. In making vaginal and bimanual examination, be very gentle, so as to avoid rupturing the fœtal cyst, if this has not happened, and also to avoid causing fresh hemorrhage, or increasing the same, if there is primary or secondary rupture.

An early gestation-sac with rupture in the extraperitoneal tissues may give signs and symptoms similar to those given by pelvic abscesses, by uterine myomata, by cornual pregnancies, etc. The following conditions may simulate an unruptured ectopic gestation-sac, anteflexion, retroflexion, pyosalpinx, hydrosalpinx, ovarian cysts, myoma, sarcoma, carcinoma of tube, ovarian neoplasms, adnexal or periadnexal tuberculosis. The early ruptured tubal or ovarian gestation-sac with free intraperitoneal hemorrhage may give some symptoms and signs similar to those of rupture or perforation of the stomach, appendix, or other abdominal viscera.

Having decided to operate, two pathways are open: 1. Through the vaginal wall (19); 2. Through the abdominal wall. In some difficult cases you may have to use both the abdominal and the vaginal route. Dr. C. P. Noble of Philadelphia (*Medical Record*, 1905, p. 717), in 91 cases of extrauterine pregnancy used the abdominal route 87 times, the vaginal route 4 times; two of the latter requiring, subsequently, abdominal sections. We recommend the vaginal route on only one condition; viz., pelvic abscesses — when the gestation-sac has been converted into a pelvic abscess, where suppuration has occurred in an intraligamentary fœtal cyst, or in all intraligamentary hæmatoma. The opening of pelvic abscesses by way of the vagina is a safe and wise surgical procedure. The results are almost always very satisfactory. 2. In those cases where the fœtal parts closely press against the vaginal wall. Even here it may be necessary to make use of the abdominal route, in addition to the vaginal route.

Under all other conditions, in the absence of a contraindication, we recommend that the abdominal route be employed, because: 1. The operator is enabled to remedy at the same time coexisting pathological conditions, as hydrosalpinx, obliteration of the abdominal ostium, etc. For instance, in Baudron's case (17), in which torsion of the pedicle of a right hydrosalpinx coexisted with a ruptured left tubal pregnancy; in Robert's case (18), in which a teratoma of the left tube coexisted with a right tubal gestation-sac. 2. It enables the operator to secure a more complete and a more careful hæmostasis to arrest the hemorrhage with greater rapidity. It enables the operator to judge better the extent of damage, to make a more direct examination, and thereby make a more accurate diagnosis. 4. It allows the operator to make a more conservative ablation of organs, and thus have the operative field much better under control. 5. It brings the operator more quickly in contact with the condition, and enables him better and more completely to remove the fœtal sac and its contents. The separated ovum may ascend in the abdominal cavity, and it may be very difficult to find and remove it by the vaginal route. 6. In case of an incorrect diagnosis, the operator can, by an abdominal incision, treat those conditions that simulate ectopic gestation. 7. Sight, as well as touch, is a very useful aid in operating in extrauterine pregnancy.

The greatest difficulty that we encounter near term, at term, or after term in operating for ectopic gestation is connected with the removal of the placenta. A slight detachment of

the placenta often results in alarming hemorrhage. There is some hemorrhage connected with the separation of adhesions, but the frightful, appalling hemorrhages come from the placental site. They may occur at the time of operation; they may occur after the operation. In ectopic pregnancy, the placental site has no contractile power; there is no maternal mechanism to stop bleeding when the placenta is divided or separated. The maximal danger exists when the fœtus is still alive or has only recently died. If the fœtus has been dead for some time, we can, without fear of dangerous hemorrhage, often remove the placenta, the vessels of which are retracted or obliterated. It would be more correct to say at times, instead of often. After fœtal death, the placental functions cease, the vessels of the cord gradually close, as do also those directly concerned in the oxygenating process of the child's blood. The placenta, if so located as to be well developed, undergoes a process of carnification, becoming more solid and tough and much less boggy; the vessels which enter it from the mother are only of a number sufficient to keep the tissues from decomposition. The placenta may be thin and spread out, having an extensive attachment. There are other cases in which the placenta forms a thick, solid lump, looking not unlike a piece of hepatized lung. In the latter kind, the vascular connections between it and the maternal structures are much less extensive, and, owing to this fact, the placenta can be removed with less difficulty. Those cases in which the placenta and gestation-sac form a well-defined tumor with a pedicle are easiest handled. Also of little complexity is the operation in those cases in which the placenta has continued to develop in the tube, in which its implantation is limited to the tube.

The relation of the placenta to the source of its main blood-supply, the extent of its attachment to the intestines, as well as the difficulties encountered through inflammatory adhesions of the sac-wall to surrounding organs, render the problem of removing the ectopic mass one possible of solution, for each individual case, only at the time of operation.

The placenta may be implanted upon the uterus, upon the visceral or parietal peritoneum, upon the omentum, upon intestines, or upon other intra-abdominal contents. It is fed by a very large number of vessels, its base being a surface, and not a pedicle. For instance, in a case reported by Neugebauer, the placenta was attached to the posterior bladder-wall, the anterior uterine wall, and to the sulcus between the uterus and bladder. In a case reported by McLean (*British Medical Journal*, 1904, ii, 1315), the tumor was found lightly adherent to the parietal peritoneum and densely adherent to the underlying uterus, to the sigmoid flexure, to rectum, to some coils of ileum, and to the left pelvic wall. Prof. T. J. Thomas reports a case in which the placenta, enormous in size, was found attached to the ascending, transverse, and descending colon. In a case reported by Ferre (de Pau: *Ann. de Gyn.*, Paris, 1902), the placenta was firmly adherent to the intestines.

To avoid repetition, we will, before beginning a description of our mode of operation at the various periods of ectopic gestation, make the following statements:

1. In all abdominal and vaginal operations, plastic work being excepted, we make use of well-fitting gloves, sterilized by heat. Well-fitting gloves detract in a slight degree only from the tactile sense. Loose-fitting gloves are clumsy, and markedly interfere with the sense of touch.

A. For our protection.

B. For the protection of the patient.

Though, when operating, we invariably use gloves, we prepare our hands with as much thoroughness as though we were to operate barehanded. To prevent the escape of any secretion by way of the space between the cuff of the glove and the wrist, we occlude this space by a piece of gauze wrapped around the wrist.

2. Immediately before the patient is brought to the operating-table, she is catheterized. Voluntary voiding of the bladder is not catheterization. This catheterization is of especial value in emotive and nervous patients: (*a*) We thereby avoid incising into the distended bladder. (*b*) We eliminate a source of annoyance and confusion (distended bladder) from our operative field.

3. We do not open the abdomen by a median incision. Our incision is to one or the other

side of the median line. We are influenced in our selection of the side by the vaginal findings. Ectopic gestation occurs with about as much frequency in one Fallopian tube as in the other; as frequently on the right as on the left side. By making use of an incision to one side of the median line, we think we can obtain a firmer cicatrix. The blood-supply in the linea alba is scant. In making use of an incision to one side of the median line, the edges of the wound are better adapted to our method of suturing the abdominal wall. (*a*) Avoid cutting the epigastric vessels. (*b*) Avoid cutting the urachus. Cutting into a patulous urachus is as serious as cutting into the bladder. The cut must be repaired. (*c*) Make use of the Trendelenburg position. The patient must be placed in this position gradually, not suddenly. The return to the horizontal posture must also be gradual. 1. The Trendelenburg position facilitates the gravitation of the intestines towards the diaphragm. 2. It permits a better view of the pelvic tissues or organs.

4. In all operations for extrauterine gestation, the opposite tube and ovary should be carefully examined. Extrauterine pregnancy in some individuals has recurred. We make this examination: (*a*) To determine the presence or absence of a former or of a coexisting pregnancy of the opposite tube or ovary (14). H. Varnier and C. Sens collected 96 cases in which pregnancy had first occurred in one tube and then in the other. None of these pregnancies were simultaneous; they were all consecutive (14). Jayle and Nandrot (14) have collected from the literature 29 other cases of bilateral pregnancies. Sanberg and Burford report a case in which conception occurred simultaneously in both tubes (14). (*b*) To ascertain the presence or absence of coexisting disease of the uterine adnexæ.

5. Never make a needless sacrifice of tissues or organs. In the absence of a positive indication, such as a highly contracted pelvis, preventing the birth of a living child, etc., never remove the unaffected tube or ovary. As most extrauterine pregnancies are tubal, early operation will permit the preservation of the ovary. The preservation of the ovaries cannot but be of benefit to the patient. Their removal will cause in the patient the appearance of the distressing symptoms of premature menopause. The prospect of sexual inabilities is distressing to patients. We think that recurrent extrauterine pregnancy is too infrequent to justify the removal of the unaffected tube or ovary. In 80 cases of extrauterine pregnancy operated on by Bouilly of Paris, there was not a single recurrence. In 40 cases operated on by Schwartz of Paris, not one case recurred. There are many cases reported of normal uterine pregnancy having occurred after operation for ectopic gestation. W. R. Nichols (*Canadian Lancet*, 1897) reports the birth of a fine, healthy child, in one of his patients, in whom, thirteen months previously, the left tube had been removed on account of its being the seat of a gestation-sac. There are many similar cases reported in the literature. The occurrence and existence of an extrauterine pregnancy does not prevent normal impregnation of the uterus. Even if the extrauterine fœtus be dead, normal pregnancies can occur.

6. The main difficulty in early and late operations is hemorrhage. The ideal treatment for hemorrhage incident to operations undertaken for the removal of ectopic gestation-sac is prophylaxis. Therefore, do not provoke uncontrollable hemorrhages. Proceed only after having well sized up the situation. Hemorrhage must be controlled by ligation or by compression of the bleeding-points. A normal salt solution must not be given before the bleeding-points have been controlled or secured, either intravenously, subcutaneously, or per rectum. Once the bleeding-points have been controlled, its use is of signal benefit. It increases the volume of the circulating fluid. Before the ligation or the compression of the bleeding-points has been effected, normal salt solution, by whatever channel it may be given, increases the blood-pressure, and is very liable to cause a recurrence of the hemorrhage, through the dislodgment of the internal thrombi. Do not close up the abdomen until you are satisfied concerning the hæmostasis. These hemorrhages are most profuse if the fœtus is alive at time of operation. The following reasons are given to explain these hemorrhages:

1. The condition of the placenta, which is still functionally active up to the moment of separating the living fœtus from it.

2. The abnormal characteristics of the placenta itself.

3. The special and ectopic position of the placenta in each individual case.

4. The vascularity of the cyst-wall.

5. The non-contractile basis upon which the placenta is located.

6. If possible, avoid leaving denuded peritoneal surfaces. Denuded surfaces are possible avenues of infection. After a unilateral ablation of the adnexæ, suture to each other the folds of the broad ligament, from the superior pelvic strait to the angle of the uterus. Peritonization — that is, the covering with peritoneum of all denuded surfaces — lessens adhesion formation. These adhesions may be attended with colicky and other pains; may cause intestinal obstruction. This peritonization lessens hemorrhage, and creates a barrier capable of limiting the extension of inflammatory processes.

7. In attempting to remove the fœtal sac and its contents, be careful, lest these efforts inflict much damage upon contiguous organs. Repair such damage before closing up the abdominal cavity.

8. In the absence of indications, we do not drain. Uncomplicated cases do not need drainage. (Bovée.) If a drain be used, it should be removed as soon as the discharge becomes serous or serosanguinolent.

9. For the last three years we have been closing our abdominal incisions, be they median, paramedian, or lateral, by a method the results of which have been so satisfactory, from the absence of stitch abscesses and abdominal wall abscesses, and from the fact that in over one thousand laparotomies we have not had a single post-operative hernia develop, that we feel justified in describing this method.

By this method, an exact coaptation of the margins of the different layers of the abdominal walls is obtained. The peritoneum, the aponeurosis, the rectus muscle, and the skin are coapted by a separate suture of absorbable material. Upon these sutures there is absolutely no tension, as all tension is relieved by supraperitoneal, or, rather, extraperitoneal, silkworm-gut figure-8 sutures, that include the rectus muscle and its two sheaths, where they are both present (the posterior sheath being absent in the lower part of the rectus muscle, it terminates in the fold of Douglas), the subcutaneous skin and tissue, at the same time that it permanently maintains in contact with the wound a wad of antiseptic or aseptic gauze. This pad can be removed only after the removal of these silkworm-gut sutures. The suture material that we employ must be either removable or absorbable.

We employ no permanent non-absorbable suture. Our suture material must meet six requirements: 1. It must be aseptic; 2. It must possess sufficient tensile strength — it must be able to bear strain without breaking; 3. It must be removable or absorbable; 4. It must last in the tissues until union has taken place; 5. It must be absorbed or eliminated after it has performed its function, which is the keeping of tissues in apposition until organic union has been effected; 6. It must not be a source of mechanical irritation. The accompanying illustrations will convey a knowledge of the sequence of insertion, and of the mode of introducing these layer sutures.

The peritoneal stitch, as you see, passes through both the peritoneum and transversalis fascia. It is introduced in such a way that the edges of the peritoneum are everted, and that the loop of the stitch does not appear in the peritoneal cavity. The advantages of this mode of introduction are:

1. That the edges of the peritoneum do not protrude between the fibers of the rectus.

2. No denuded area on the peritoneal surface of the suture line; no stitch-loop on the same surface; hence little if any liability to post-operative adhesions. Post-operative peritoneal adhesions can be a source of great discomfort, and also a source of danger.

After the peritoneal stitch, we introduce the figure-8 silkworm-gut stitches; the upper loop includes skin and subcutaneous tissues; the lower includes the sheath and the muscular fibers of the rectus. Hæmostatic forceps are placed upon each end of the suture, so as to avoid confusion. Confusion entails loss of time. The silkworm-gut stitch, as you see in the cut, is extraperitoneal. It does not carry infection into the peritoneal cavity. This silkworm-gut enters and emerges at the surface, after having twice crossed transversely the

line of incision. It is intended that it should be removed. It can be introduced more easily if the suture be needled at both ends. The fascial stitch, which is of catgut, restores the continuity of the sheath of the rectus. Exact apposition and firm union of all wounds of the aponeurotic coverings is essential to the non-occurrence of hernia.

Then the subcuticular stitch is introduced. This stitch, as you see, is an intradermic stitch. It is continuous, and does not penetrate the upper layers of the skin. Next, a pad of aseptic gauze of sufficient width to occupy all the space between the point of entrance and the point of exit of the silkworm-gut sutures is placed over the line of incision, and the silkworm-gut stitches are tied over it. We have in this guaze an elastic body which prevents any great constriction, and which protects the wound, however restless, unmanageable, or delirious the patient may be, from secondary contamination. The wound is covered with a voluminous gauze dressing, no dusting-powder being used. Gauze is maintained in position by strips of zinc oxide adhesive plaster. We prefer zinc oxide adhesive plaster on account of its aseptic, markedly adhesive, and non-irritating properties. The abdominal binder which covers the whole is prevented from slipping upwards by perineal straps passing around each thigh.

The first condition the treatment of which we will consider is that of early unruptured ectopic pregnancy. In this case, there are usually no adhesions. If adhesions be present, they are separated, as in all other intra-abdominal surgical interventions, with great care and by the same methods. We will, in these cases, as in all others, observe all the precautions mentioned in the preceding paragraphs concerning treatment. The incision is carried through the different layers of the abdominal wall into the peritoneal cavity, making our incision about three inches in length. The incision is slightly to one side of the median line. It is an infraumbilical incision. After the patient has been gradually placed in the Trendelenburg position, the intestines and the general peritoneal cavity are walled off from the pelvic cavity by compresses of gauze. The first step is to locate the uterus. The uterus is a body so large, and so firm, and so different from everything else that is felt in the peritoneal cavity, that there is little difficulty in its identification by touch.

Using the fundus of the uterus as a guide, and proceeding to the right and to the left, examine both tubes and both ovaries. Ectopic pregnancy is located with about as equal frequency on one side as on the other. Separate the gestation-sac from any adhesions, if such exist. Then remove the gestation-sac (which is usually tubal), as a whole, if possible, by a typical resection of the Fallopian tube involved. Suture the folds of the broad ligament together; leave no denuded peritoneal surfaces. Close up the peritoneal cavity. Post-operative treatment is that of uncomplicated laparotomy. If the pregnancy be ovarian in type, and be early and unruptured, do a typical ovariotomy. Accuracy and rapidity in operating is as essential in these cases as in any other intra-abdominal work.

If the gestation-sac is ruptured and hemorrhage has occurred or is occurring, after opening the abdominal cavity put the patient in a Trendelenburg position. Wall off the general peritoneal cavity by gauze compresses. Again, immediately locate the fundus of the uterus. Determine on which side is the ruptured gestation-sac. Seize the uterus with a double tenaculum, thereby locating and keeping in view the most important land-mark. When you have determined on which side the rupture is (it is usually tubal), apply a clamp at the uterine end of the tube. This will stop all further hemorrhage from the ovarian artery of that side. Apply another clamp immediately below the tube, compressing the folds of the broad ligament, but not injuring the ovary. Then remove the affected tube and the gestation-sac. Ligate all bleeding-points, suture the folds of the broad ligament and the tubal surface of the uterine stump. Remove as expeditiously as you can the easily removable blood and blood-clots contained in the peritoneal and pelvic cavities. Remove the embryo if it can be found without prolonged search. Let there be no needless exposure, no needless traumatizing of the intestines. Undue exposure, undue handling of the intestines, intensifies operative shock, and may be followed by the aperistaltic

form of ileus. Post-operative treatment is that of acute internal hemorrhage for which a laparotomy has been performed. Use normal saline solution secundum artem.

We will close this article by considering the treatment of those causes of extrauterine pregnancy that are near term, at term, of after term. The most dangerous conditions, from the maternal standpoint, are those in which the fœtus is alive; the hemorrhage then may be fatal. In these alarming cases of hemorrhage, some authors have suggested that the abdominal aorta be compressed. If the placenta be attached to the line of incision, the hemorrhage will be profuse, but can be stopped by firm compression. In those cases in which the fœtus is alive, we have two things to accomplish, and they must be accomplished with the preservation of the mother's life. The preservation of the mother's life must ever be in our thought. The first thing to accomplish is the removal of a living child. The last and most important is the removal of the ovum; that is, the placenta, membranes, etc. We shall not often be called upon to operate in cases in which a living child is present. For a physician knowingly to abstain from operating in a case of extrauterine pregnancy before it reaches term is, to say the least, injudicious. The teaching will always be to terminate these pregnancies early, or before the development of the ovum is much advanced. Delay in operating is hazardous, and exposes the mother to the many dangers that we have previously cited.

Though there may be some discussion in the early stages as to which route is preferable — the abdominal or the vaginal — both routes having able supporters; though there may be some discussion as to whether we should partially or completely remove the affected tube (Emil Ries of Chicago teaches that a conservative operation can be wisely performed in some forms of tubal gestation) — there can be no discussion as to the advisability of terminating these pregnancies early. The ova in these pregnancies may be regarded as malignant growths; that is, as new growths that must be removed completely, and as early as possible.

Remove the fœtus without disturbing the placenta. If the fœtus is alive, the first thing to do after having opened the abdominal cavity and protected the peritoneal cavity by compresses from the outflow of amniotic fluid, is to remove the fœtus, the umbilical cord having been ligated as in a normal pregnancy. Have the amniotic fluid escape externally as much as possible. Upon the maternal end of the umbilical cord a clamp is placed, the umbilical cord being cut either between the ligature and the clamp or between two clamps. If at birth the fœtus is in a condition of asphyxia neonatorum, employ the usual methods of resuscitation. Fœtuses developing in extrauterine sacs are fœtuses that have developed under abnormal conditions of existence. These children will need a good deal of care during the early periods of life.

Removal of the sac is effected as stated later. If the fœtus has reached term or near term and is dead, there is some difference of opinion as to which operation is the preferable elective method — the immediate operation or the delayed operation — until the fœtus has been dead for a month or longer. Our experience leads us to believe that the dangers attending delay are more than counterbalanced by the numerous dangers incident to the policy of expectancy, so that if the fœtus is dead, be that death recent or of some standing, we will, after thorough preparation, incise the abdominal wall. Exceptionally, our incision may carry us into the fœtal sac. In such cases the peritoneal cavity will not be opened. This is liable to occur in some extraperitoneal or broad ligament pregnancies. In this variety, the sac and placenta are entirely beneath the peritoneum. The latter may have been pushed up, even stripped for a considerable distance from the anterior abdominal wall. We will hastily remove the fœtus without disturbing the placenta, ligating the umbilical cord near the placenta. Evacuate the contents of the sac, and then attempt to remove the sac and the placenta together, after having separated them from the surrounding structures to which they may be adherent. Usually, however, our incision carries us into the peritoneal cavity. In this instance, the patient is gradually placed in the Trendelenburg posture. The adherent intestines, omentum, and other viscera are separated, if feasible, from the sac, by tearing the adhesions apart or cutting them between

ligatures. Hemorrhage must be controlled as you proceed. The general peritoneal cavity is wholly protected by gauze compresses, which are numbered and counted, and then the incision is carried into the ovum. Occasionally, you may be able to remove the ovum as a whole. I have never seen a case of advanced extrauterine pregnancy in which this could be done. If the placenta is not safely removable, if the nature of the adhesions of the surrounding organs to the ovum is such that their separation would prove disastrous, content yourself with evacuating the fœtal cyst and then suturing its walls to the abdominal wound. The sac must be packed daily until the placenta has been expelled and the sac-cavity obliterated. If the placenta is to be left behind, it is better if this fact be recognized before it is disturbed and made to bleed.

Now, the great difficulty comes in those cases in which the entire ovum cannot be removed, and that great difficulty lies in the removal of the placenta. Another difficulty is due to the presence of dense adhesions of the cyst-wall to surrounding tissues and organs, and also to its great vascularity. The following methods have been employed:

1. The fœtus, the umbilical cord, and the amniotic fluid have been removed. Everything else has been left *in situ* and the abdominal wall closed. This is an extremely risky experiment. It has been done, however, with success. In favorable cases, the placenta is painlessly and gradually absorbed.

2. The fœtus is removed, and more or less of the sac is resected. Drainage of the cavity of the sac is employed, and the placenta and sac are left for spontaneous expulsion. This is the most frequently employed procedure.

3. After the removal of the fœtus, umbilical cord, and amniotic fluid, the placenta is removed in part — so much of it as is early separated — and the remainder is left to spontaneous absorption.

4. The placenta is left *in situ* after removing the fœtus. Then, after the expiration of a certain time, the placenta is shelled out, when it is hoped that the blood-supply is spontaneously cut off.

5. The placenta and entire ovum are removed immediately. Ideal measure, if feasible.

6. The placenta and gestation-sac are removed at once, likewise the neighboring organs, the uterus and ovaries, providing the hemorrhage cannot otherwise be arrested. This is the method that has been employed in those numerous cases that have called for supra or total hysterectomy. In these cases, arrest of the bleeding could not be obtained in any other way.

7. Vineberg, thinking that the mortality has increased sixfold by leaving the placenta *in situ*, proceeded in a difficult case as follows: He first ligated the vessels on the free side — the uterine and ovarian vessels, then cut the uterus across, at the level of the os internum, without making any attempt to separate it from the mass to which it was intimately adherent (placenta), and then ligated the uterine artery on the involved side, finishing by removing the uterus and the ectopic mass, thus performing what may be called partial hysterectomy. His patient recovered.[7]

8. Preliminary ligature of the uterine and ovarian arteries of the side from which the placenta receives its blood-supply, followed by removal of the placenta. Martin reported remarkable control of alarming hemorrhages, after tying the uterine and ovarian arteries on the affected side.

There is no disputing the fact that the fœtal sac and placenta should be removed completely if the procedure be consistent with the safety of the mother. The complete ablation of the ovum is theoretically the only perfect operation. It does away with all the subsequent dressing of the case; it does away with the slow and tedious expulsion of the placenta, with the dangers of sepsis that attend this slow elimination of the placenta; it markedly shortens the patient's convalescence; it does not expose them so much to post-operative hernia.

The method that we have had occasion to follow in those cases in which we feared to disturb the placenta is the following: After having incised the sac, we remove the fœtus and other intraovulary contents, and ligate the umbilical cord close to its implantation, resect a portion of the sac-wall and sew what is left to the abdominal wound. This closes off the general

[7] H. N. Vineberg. Extrauterine Pregnancy at Full Term: Total Extirpation of Uterus and Placenta by a New Technic. American Medicine, Philadelphia, 1905, vol. ix, p. 542.

peritoneal cavity. It leaves us a large pouch, which we pack tightly with strips of aseptic gauze. Many authors employ iodoform-gauze instead. We endeavor to keep the cavity of this sac aseptic until all the placenta sloughs out of the wound. The elimination of the placenta by this method takes from twenty to fifty days. Boissard reports two cases, in one of which it took twenty-six days — a case of a dead fœtus; in the other — a case of a living child — it took forty-five days.

In some cases, a vaginal drain has to be used, in addition to the abdominal drains. The first strips of gauze that are inserted in the fœtal sac are made to serve the offices of a compress and of a tampon. They are used to check the bleeding. After the first dressings, the gauze strips are used more with drainage in view. After the fœtal cyst has been sewed to the abdominal wall, or immediately previous, according to the exigencies of the case, the compresses that have been used to protect the general peritoneal cavity are removed. Sewing of the sac-wall to the abdominal wound shuts off all communication between the cyst and the peritoneal cavity. We use No. 3 catgut to suture the sac-wall to the abdominal wall. In some cases it will be found necessary to irrigate this pouch during the subsequent dressings, with some astringent aseptic or antiseptic solution. The abdominal wound is closed as in those cases in which a Mikulicz drain is employed. Post-operative treatment, symptomatic.

SUMMARY

1. Only 3 of these women gave a history of previous sterility; 16 had had one or more children; 9 had had one or more miscarriages. One of these patients had 7 children; another, 8; two had 4 each.

2. Our youngest patient was 18 years old; 1 was 19 years old; the oldest was 42; the next to the oldest, 40 years old; 11 were between 30 and 40; 15 were between 20 and 30.

3. Signs of pregnancy, such as tender breasts, enlarged uterus, softened cervix, were noted in about half of the cases.

4. Pain in the lower abdominal region, menstrual irregularities, such as delayed or skipped periods, continuous vaginal hemorrhage, passage of a uterine decidual cast, etc., and a palpable mass in one or the other, or in both, fornices, were present, respectively, in 30, 28, and 31 cases.

I note these three symptoms under a special heading because I believe that their presence is highly suggestive of ectopic gestation, and because I believe that the above justifies us in holding that the following symptoms, when associated, are most important aids in the diagnosing of extrauterine pregnancy:

(*a*) Abnormalities of menstruation.

(*b*) Pelvic pain usually referred to one ovarian region.

(*c*) Presence of a pelvic or pelvo-abdominal mass, almost always distinct from the uterus.

(*d*) In rupture, signs of internal hemorrhage varying from increasing pallor and fainting-spells up to complete collapse.

5. Conception took place in the right Fallopian tube 17 times; in the left, 14 times; and not determined, once. In 91 cases operated on by C. P. Noble (20) of Philadelphia, pregnancy was in the left tube in 44 cases; in the right, in 40 cases; in 7, the report did not show in which. In 101 operations for extrauterine pregnancy reported by Hörrman (Munich), 51 were right tubal gestations; 50 were left tubal pregnancies.

6. Thirty cases were treated by the abdominal route, one by the vaginal route, one by the combined (vagino-abdominal) route. The latter case died. Drainage was employed in nine cases, necessitated in almost all instances by capillary oozing, which, apparently, could not be otherwise controlled.

7. There were two deaths in the series, each due to acute generalized peritonitis. In one case, numerous adhesions had to be torn; in the other cases the pregnancy was much advanced, and the operation was very complicated. Except in the two cases which died, recovery was rapid and uneventful.

CASE REPORTS

Pain, intermittent and colicky in character, was complained of by 23 of the patients; 5 experienced a single severe pain preceding rupture of the ectopic mass. In 20 cases, palpation of the mass produced severe pain, and in but 2 instances was manipulation of the tumor unattended by pain.

Other details will be noted in the reports.

REPORTS OF CASES

The patient's previous history, her present illness, the findings at the time of operation, and the type of operation, have been transcribed in the exact words used by the medical attendants in the case. We have reported only cases in which the diagnosis was positively confirmed by sight at the time of operation, so that each and every case is one of extrauterine pregnancy. By eliminating errors in diagnosis, we thought to make our reports more trustworthy. Many of the patients were of foreign birth, and being unfamiliar with the English language, a complete history of past and present illnesses could not be elicited. A more complete history of these cases can be obtained by consulting the original records at the Cook County Hospital.

Case	Previous History	Present Illness	Laparotomy	Result
Case 1. Teresa Romadzei. Age 40. Jan. 10, 1899. Dr. Delprat.	Patient has 7 children; last one a year ago.	Eight days ago, patient had pain in right iliac region; was compelled to go to bed; vomited once; menstruated 4 weeks before; was awakened during night by severe pain; symptoms of acute anæmia; vaginally, posterior a soft irregular mass is felt filling hollow of sacrum; right tube and ovary included in mass.	Adhesions between tumor, omentum, and adjoining structures broken up; drainage; tumor found to include ovary, broad ligament, outer extremity of tube; entire mass removed; bowel movement second day after operation.	Recovery.
Case 2. Mrs. Anderson. Age 29. Sept. 13, 1899. Dr. Hartman.	Her usual menstrual interval is 3 weeks; first pregnancy 6 years ago; miscarriage at seventh month; second pregnancy 2 years ago; spontaneous abortion at second month.	Three weeks ago, patient began to have menstrual flow, which was scanty for 4 days and then became profuse; continued until present time; flow painless; before onset of flowing has not menstruated for 5 weeks; vaginally, in felt fornix and a little behind uterus, a mass is felt, not tender, size of lemon, consistence that of muscle tissue.	First operation. September 14, 1899: During manipulation, tumor disappeared; uterus curetted. Second operation, October 6, 1899: Left tube and ovary removed; abdominal cavity contained, in vicinity of pelvic viscera, much dark tarry blood; this came from a ruptured cyst in left broad ligament; drainage; bowel movement next day; drain removed in 24 hours.	Recovery.
Case 3. Maggie Crockett. Age 26. Oct. 6, 1899. Dr. Murphy.	One child, 8 years old; abortion at third month 7 years ago.	About 2 months ago began to flow; has continued ever since; abdomen, extreme tenderness in median line, just above pubes; shows nodule, diameter that of thumb, running behind cervix from left side; vaginal examination difficult, owing to extreme tenderness; pressure either on cervix or on abdominal wall over uterine region causes great pain.	On attempting to raise a large cystic mass behind the uterus, it ruptured; the right tube seemed to end in the mass: right ovary and tube removed; no drainage; bowel movement 5 days after operation; much vomiting and tympanites after operation.	Recovery.
Case 4. Hannal Youngren. Age 28. Oct. 11, 1899. Dr. Williams.	Has missed one period; 3 children well; no abortion; menstrual flow always regular; not much pain during any period.	Began with bloody discharge from vagina; bearing-down pain in lower part of abdomen; had missed one month; pain more severe on right side; discharge ceased soon after curettement. Physician outside told her she had an abortion, and curretted her 2 weeks after beginning of flow. Vaginal examination: Mass fills cul-de-sac; fills right fornix and also left fornix. Pulse, temperature, and respiration normal previous to operation.	Supravaginal hysterectomy; no drainage; removal of tumor mass, which included portion of uterus and both tubes and ovaries; large mass was found covering over uterus and filling lower pelvic cavity; the mass was free on right side; right tube and ovary not enlarged; mass was opened; contents semiclotted blood; washed out peritoneal cavity; allowed NaCl solution to remain in cavity; bowels moved day following operation.	Recovery.
Case 5. Mary Carter. Age 38. Oct. 28, 1899. Dr. Tucker.		Patient has noticed for some weeks a tender point over right ovary; for a week has had spasmodic attacks of pain, with discharge of some blood from vagina; flows considerably; abdominally, much pain on palpation over right ovary; vaginal examination shows a tumor mass in right broad ligament, which fluctuates to the touch and is quite tender.	Right tube and ovary removed; no drainage; bowel movement third day after operation.	Recovery
Case 6. Nellie Lacey. Age 26. Jan. 1, 1900. Dr. Van Hook.	Two children, 6 and 3 years, respectively; never had a miscarriage.	Began 2 weeks ago; patient had passed the monthly period; about a week before, lifted something heavy; got labor pains, and began to flow; tenderness over entire lower half of abdomen; more marked in right inguinal region; vaginally, in front and at side of uterus is a mass which feels like a pregnant uterus, non-fluctuating, tender; left tube can be felt curled downward at left of cervix, and is much enlarged; fullness is more marked at left of cervix than anywhere else.	Right tube removed; on opening into pelvic cavity, large quantity of dark blood flowed out; it had a fæcal odor, but showed no trace of pus; right tube found dilated and ruptured; bowel movement second day after operation.	Recovery.
Case 7. Mrs. M. Porter. Age 33. May 18, 1903. Dr. Davison.	Vaginal discharge for the last 7 months; aggravation last 4 weeks; pain in left lower pelvis; menstrual history negative; 1 pregnancy 9 years ago; 1 miscarriage.	Vagina full of purulent discharge; uterus fixed and pushed to right; in left fornix a fluctuary mass is felt; pulse, temperature, and respiration normal.	Incision in median line of abdomen; left tube found enlarged, swollen, and surrounded by friable adhesions; removal of tube; modified Mikulicz drain passed to denuded area, which was removed on following day; bowels moved on next day; healing by delayed primary union.	Recovery.

Case	Previous History	Present Illness	Laparotomy	Result
Case 8. Cecelia Routh. Age 38. July 7, 1903. Dr. Doane.	Married 10 years; no previous pregnancy; no venereal history; 5 months previous had some irregularity in amount and duration of periods; since then has been normal.	Sudden pain over entire right side, colicky and crampy in character, followed by vomiting; tumor extending from pelvic portion into abdomen, about umbilicus; vaginal discharge of blood; prostration.	Large cyst closely adherent to abdominal wall and to surrounding viscera; tube was bleeding copiously; no fœtus found; removed right tube; ends of ligament sutured; bowels moved second day after operation; no drainage.	Recovery
Case 9. Betta Wallace. Age 34. Oct. 10, 1903. Dr. Kahlke.	Two months previous to admission missed a period; following this, began to notice that she was flowing every night; at the regular time of menstruation, began to flow continuously, physician performed curettage, with no result; child 2 years ago.	A rounded mass can be palpated in right iliac region, about size of orange, not tender; excessive secretion from vagina; sanguineous discharge from uterus; in left and posterior fornix, mass could be palpated; uterus movable.	Removal of a 2 months' fœtus with its placenta and inclosing sac from left tube; through-and-through drainage introduced; first bowel movement 5 days after operation.	Recovery.
Case 10. Lizzie Lidora. Age 28. Nov. 20, 1903. Dr. Grosvenor.	Has not menstruated for 2 periods; unmarried.	Six days previous, patient began to have pain in inguinal region; lost some blood per vaginam; 3 days ago had more pain and hemorrhage; patient in collapse; symptoms of acute anæmia; marked tenderness over right inguinal region; dullness in right flank; marked rigidity throughout; marked tenderness in right vaginal fornix.	Uterus small; to right of uterus a sausage-shaped mass was palpable between both hands; seems to be about twice thickness of thumb; fimbriated end of tube dilated to size of walnut; on opening abdomen, gushing of about 1 quart of dark blood; ligated tube at uterine end and cut; no drainage; first bowel movement second day after operation; union by first intention.	Recovery.
Case 11. Mrs. McFadden. Age 36. March 28, 1904. Dr. Warren.	Has had more or less pain in left ovarian region for years, and claims that she has had peritonitis when young; had vaginal discharge at that time.	Began 2 weeks ago; cutting pains in lower abdomen; pains have increased in severity; abdomen very tender and rigid; vaginally, to the left is a large, irregular, extremely tender mass.	Left tube distended and purplish in color; it is adherent to the uterus and cul-de-sac; old blood-clot in cul-de-sac; tube brought up and ruptured; about 6 weeks' fœtus escaping; mass removed, including left tube and ovary; blood-clots removed; Mikulicz drain inserted; drain removed in 24 hours; bowels moved freely on second day.	Recovery.
Case 12. Margaret Howard. Age 33. April 7, 1904. Dr. Schroeder.	No children; 1 miscarriage.	Acute colicky pains on right inguinal region; painful defecation; in right vaginal fornix is felt a mass tender and sensitive to touch.	Right tube very much dilated; tortuous walls; contents of tube found to be dark grumous material, with considerable clotted blood; ovary necrotic; both tube and ovary on right side removed; no drain; bowels moved three days after the operation.	Recovery.
Case 13. Josephine Powers. Age 32. April 20, 1904. Dr. Reed.	Four children; last pregnancy 4 years ago.	Began 1 month ago with colicky pains in left inguinal region; pain began after patient had missed third menstrual period; in right iliac region tumor mass can be felt, sensitive, painful; in right vaginal fornix, tumor mass easily palpable.	Mass found lying just above and adherent to right tube; over mass, sigmoid and several loops of small bowel were very adherent; tumor freed from adhesions and removed at corner of uterus; right tube removed; no drainage; bowels moved on second day.	Died from acute peritonitis.
Case 14. Mary Bensen. Age 22. May 7, 1904. Dr. Kreissel.	Last flow was not as profuse as usual; married 6 years; never pregnant.	Began 2 days ago with severe, intense, colicky pain in right lower quadrant of abdomen; nausea, vomiting; profound shock; abdomen rigid, painful, tender; slight induration in right vaginal fornix; patient very restless.	Cavity contains large amount of blood, clotted; right tube ruptured, and adherent to it was found a mass about size of small hen's egg; right ovary and tube enlarged and firmly adherent to one another. Right salpingo-oöphorectomy performed; no drainage; healed by first intention; secured bowel movement on second day; tympany.	Recovery.
Case 15. Emma Hokanson. Age 24. May 26, 1904. Dr. Rowan.	One child 3 years ago; ever since has had some trouble in right side.	Began 2 weeks ago with sharp cramping pain in ovarian region; continuously intermittent ever since; has been flowing continuously ever since; is flowing now; vaginal examination shows irregular mass in left side, also mass on right side near other end of tube; pulse 120; temperature and respiration O. K.	Right tube enlarged at fimbriated end, and adherent at ovary; blood-clot escaping on separating adhesions; tube purple-looking; right tube contained hemorrhagic membrane; left tube and ovary matted together; no pus seen; right tube removed; part of right ovary removed; left tube and ovary removed *en masse;* uterus curetted; no drain; bowels moved second day after operation; tympany.	Recovery.
Case 16. Mrs. Sadie Smith. Age 26. July 24, 1904. Dr. Schroeder.	Last menstruation lasted about 2 weeks; 2 children; no miscarriages.	Began about 3 months ago; first noted severe pain in lower part of abdomen; had nausea and chilly sensation; soreness in left side during this spell; soreness in left lower quadrant now; pulse, temperature, and respiration normal.	Vaginally, on left side of uterus found semifluctuating mass, size of small orange; mass seems a little anterior to level of uterus; on left side of uterus found some old blood-clots and a sac (extrauterine pregnancy); removed left Fallopian tube and blood-clots; no drain; bowels moved on day following operation.	Recovery.

Case	Previous History	Present Illness	Laparotomy	Result
Case 17. Mary Hoffer. Age 23. Aug. 10, 1904. Dr. Ryan.	Patient had an abortion 8 weeks ago, at "3 weeks"; had more or less pain in lower abdomen; has been bleeding a little every day since that time; says that she is growing weak from loss of blood; married 1 year; 1 miscarriage eight weeks ago.	Considerable tenderness in suprapubic and both iliac regions; hemorrhage from vagina; in posterior part of fornix is a tender mass, just behind cervix, quite firm in consistence; it does not seem to extend more to one side than to the other; same mass can be felt per rectum.	Right tube found distended to more than walnut size, and at one point very dark blood exuded; left tube moderately enlarged, smaller than right, with ovary adherent to and inseparable from it; right tube filled with a firm blood-clot; no trace of fœtus or membranes; left tube simply that of chronic interstitial change, with slight hydrosalpinx; patient in Trendelenburg position; right tube removed; left salpingo-oöphorectomy; right ovary contained a few cysts, which were punctured; drainage; patient developed generalized bronchitis; bowels moved on third day; all drainage discontinued on seventh day.	Recovery.
Case 18. Mrs. Frank Muller. Age —. Aug. 20, 1904. Dr. Grosvenor.	Eight children; last born 1 year ago; 1 miscarriage.	Two weeks ago had a sudden and severe attack of pain in lower abdomen and pelvis, followed by fainting and feeling of great weakness; since then, slight bloody vaginal discharge; has missed one period at the end of July; a mass, walnut size, felt high to right of uterus, not close to it, and freely movable.	On opening peritoneal cavity, dark half-clotted blood flowed out in moderate amount; right tube found seat of a hæmatosalpinx that had ruptured into abdomen, near fimbriated extremity; nearly a pint of free blood found in cul-de-sac of Douglas; a small mass found near distended tube, attached to it by firm adhesion; curettement; right tube removed; ovary had pea-sized cyst, which was punctured; no drainage; curettement; bowels first moved 4 days after operation; wound healed by first intention.	Recovery
Case 19. Anna Justi. Age 31. Oct. 7, 1904. Dr. Garrold.	Patient had always menstruated regularly until last 2 months, when she failed to flow.	On evening before admission, patient was seized with severe pain in the abdomen; patient has a bloody discharge from vagina; at time of admission was suffering from symptoms of acute anæmia; abdomen gave dullness in both flanks; tenderness general; rigidity not marked.	On opening peritoneum, considerable blood escaped with pressure; a mass was palpated in region of right tube; this was delivered through the abdominal opening; rupture in tube was found, and fœtus and covering about size of index finger was shelled out; right tube excised; blood-clots removed; no drainage; bowels moved third day after operation; healing by first intention.	Recovery.
Case 20. Kate Maroge. Age 30. Feb. 16, 1905. Dr. Heywood.	Married; indefinite history of 1 abortion; menstrual history, usually regular; none since Christmas, until 5 days ago, when slight began, and has continued ever since.	Began 4–5 weeks ago with pain in pelvic region and back; this becomes very severe at times; uterine canal elongated. Vaginal examination: Fundus of uterus much enlarged, apparently; in left fornix there is a fluctuating enlargement; in right fornix, firm, tender, smooth mass. Rectal examination: Hard, fairly regular mass felt to right of uterus, and apparently in union with it; to left and behind fundus is a soft, fluctuating mass which extends out to region of adnexa, also tender. Pulse 128; temperature 96°; respiration 20.	Laparotomy; bowels moved on second day after operation.	Recovery.
Case 21. Bike Jansen. Age 37. March 15, 1905. Dr. Eisendrath.	Mother of 4 healthy children, youngest 7 years; 5 years ago miscarriage.	For past month has been in constant pain; pain so intense that she would have to cry out; vaginally, mass in left fornix, connected with uterus, very firm; bloody discharge from vagina.	In left pelvic region, found mass of dark blood leading down into cavity, formed by left tube and ovary; tube and ovary and mass, presumably ectopic gestation, clamped, ligated, excised; Mikulicz drain left to drain wound; first bowel movement 3 days after operation; a sinus leading to the left horn of uterus persisted, for which an operation had to be performed.	Recovery.
Case 22. Belle Spore. Age 23. March 18, 1905. Dr. Reed.	Patient delivered of normal child last September; had then puerperal fever; regained her usual health.	Ceased menstruating in December; took ergot; pelvic pain, like labor pains; abdominally, tumor mass, 4 inches above symphysis, more prominent on right side, very tender.	Patient operated on, but no detail of operation recorded.	Recovery.
Case 23. Liddie Freeman. Age 19. June 8, 1905. Dr. Heineck.	Negative.	Six weeks ago, fainted, vomited, and had pain in abdomen; no vomiting; tenderness over lower part of abdomen; vaginally, a mass posteriorly to left of uterus, quite tender.	Opening in cul-de-sac, where a large drain was inserted; considerable pus appeared; removal of ectopic gestation-sac with what was apparently one tube; Mikulicz drain inserted; first bowel movement second day after operation.	Recovery.
Case 24. Mrs. Ellen Kuntz. Age 33. May 11, 1905. Dr. Holmes.		Patient for last six weeks has had pain, continuous flowing and dribbling; vaginally; a large mass can be felt filling pelvis, pushing uterus forward, reaches away to umbilicus.	Abdomen opened and closed; vaginal drainage and packing; May 12, 1905, first strip removed from pelvis; May 13, 1905, second strip removed from pelvis; first bowel movement day following operation	Died on May 27, 1905, of acute peritonitis.

Case	Previous History	Present Illness	Laparotomy	Result
Case 25. Bertha Hastings. Age 29. May 20, 1905. Dr. Heywood.	Has had 2 children; menses O. K. until past month.	Patient has been sick for 1 week, with severe pain in left side and some fever, also has lost considerable blood for the past month; left fornix bulging, also cul-de-sac; indefinite mass can be felt.	Vaginal section; gauze pack and tube drainage.	Patient left the institution improved
Case 26. Mary Stankowski. Age 24. Jan. 10, 1906. Dr. Kahlke.	Speaks no English; comes with diagnosis of pus-tubes.	Examination shows much tenderness in pelvis; large mass in cul-de-sac and lateral fornices; vaginal hemorrhages.	Right tube removed; large hæmatoma; drained vaginally; first bowel movement on day following operation.	Recovery.
Case 27. Kate Spearman. Age 23. April 13, 1906. Dr. L. Ryan.	Married 6 years; never been pregnant; never had vaginal discharge.	Two weeks ago taken with sudden pain in her abdomen; began to flow; was overdue 2 weeks; nausea; breasts tender and slightly swollen; pulse, temperature, and respiration normal; abdomen tender and rigid on palpation; marked tenderness in vaginal vault, and boggy feeling.	Trendelenburg position; upon opening of peritoneal cavity, dark blood flowed out; right tube was ruptured near fimbriæ. Operation: Right tube and ovary were removed from a bed of dense adhesions; blood-clots removed; no drainage. Bowels moved in 36 hours; abdominal wound healed by first intention; some tympany.	Recovery.
Case 28. Anna Godfrey. Age —. June 27, 1906. Dr. Halstead.	Pregnant 4 times; 2 births; 2 miscarriages.	Patient well until 3 weeks ago, when her menstrual period occurred a week earlier than usual; it was attended by considerable hemorrhage; it was longer than usual; yesterday, sudden onset of severe pain in right abdominal quadrant; this was cramping in character, doubling patient; a superficial swelling, involving tube and broad ligaments, from ruptured tubal pregnancy; vaginally, a large, rather resistant mass in right side, pushing down the right vault; no vaginal discharge.	Right tube removed; cigarette drain inserted to control oozing; first bowel movement second day after operation.	Recovery.
Case 29. Agnes Dumolski. Age 18. July 11, 1906. Dr. Besley.		Began yesterday, with pain in right iliac region; menstrual flow since yesterday; abdomen rigid; pain most marked in McBurney's point; leucocytoses, 24,000.	Large clot of blood found posterior and to left of uterus; clot was walled off by intestine, omentum, uterus; clot removed; left tube clamped, cut away, and free cut margin of broad ligament; sutured with running catgut stitch; no drainage; bowels moved on third day after operation.	Recovery.
Case 30. Eliz. Maticzski. Age 27. July 30, 1906. Dr. Bushnell.	Has 1 living child 10 years old; 1 child died soon after birth 8 years ago; no pregnancies since; menses regular until last one, when she flowed ever since.	Patient has been ill for 6 weeks, with great abdominal pain and bloody discharge from vagina; vaginally, in posterior fornix, hard, firm, large mass continuous with cervix; mass is also palpable in left lateral fornix; it extends considerably to right; is easily palpable through abdominal wall; white blood, 12,600.	Behind uterus in cul-de-sac was a mass of intestines bound by adhesions; cylindrical cyst-wall about 8 cm. deep and 3 cm. behind uterus, with wall about 7 m. thick; there were adhesions everywhere, both old and fresh; increased vascularity everywhere; right tube distended to size of goose-egg fœtus was about 2 cm. long, apparently about in fourth or fifth week of gestation; right salpingo-oöphorectomy; drain; bowel movement second day after operation.	Recovery.
Case 31. Mary Ritzert. Age 42. Nov. 24, 1906. Dr. F. A. Besley.	Patient married at 27; has given birth to 6 children; youngest is 2½ years; no miscarriages; she says she was 2 weeks past time when she began menstruating 2 weeks ago; is flowing now.	Patient dates her illness back 3 weeks, at which time she was seized with severe abdominal pain in lower abdominal regions; this continued for a few hours; for past 2 weeks has had progressive trouble with urination; bowels constipated; uterine body somewhat enlarged; cervix somewhat softened; leucocyte count, 12,700; distinct, palpable mass can be felt through abdominal wall, with patient under anæsthesia; vaginal mass can be felt in left fornix.	On opening up abdomen, large amount of dark blood visible; mass on left side proved to be dilated and ruptured tube; it was delivered and clamped up; fœtus apparently 6 weeks old found loose in peritoneal cavity; mass formed by the tube had caused to be formed by numerous adhesions a distinct cavity, the walls of which were formed by rectum, bladder, and small intestines; no drainage.	Recovery.
Case 32. Mrs. Alice Gorman. Age 29. Oct. 21, 1906. Dr. Heineck	Patient has not been well since her first baby was born 8 years ago; first baby 8 years ago; last baby 3 years ago; 2 miscarriages; 1 induced; has not been pregnant for 3 years; menstrual history, always regular; flow rather scanty; last menstrual period September 22, 1906.	Was taken suddenly ill on October 20, 1906, with severe abdominal pain, mainly in lower abdomen; she had been in bed one week before onset of this very acute attack; on October 13, 1906, she was compelled to go to bed on account of severe pain in region of left tube; patient felt as though something was gathering there; on the 20th she went to the toilet and felt as if something had given away—in her own words, thought her womb had fallen; patient tolerated no palpation of abdomen; right side of belly distinctly tender; a mass felt on left vaginal fornix.	On opening peritoneum a large amount of blood escaped from abdominal cavity; left tube showed at end nearest ovary an enlargement to about 1 inch in diameter; this area contained cavity size navy-bean; left salpingectomy; blood was evacuated as well as possible without taking out intestines; microscopic examination of histological section of tube shows typical findings of tubal pregnancy; chorionic villi and diffuse hemorrhages in the tube-walls. Vaginal examination when patient left the hospital November 1, 1906, showed uterus freely movable in normal position; right ovary palpable; slight tenderness in region of left tube.	Recovery.

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GUNSHOT WOUNDS OF THE CRANIUM[1]

By CHARLES ADAMS, M. D., Chicago

IN the short time at my disposal this evening, it will be impossible to do more than to give an outline of the extraordinary variety of injuries which may be inflicted by the modern military rifle-bullet upon the cranium and its contents, and to summarize in as concise a method as possible the lines upon which treatment should be instituted.

The subject is worthy of more lengthy consideration, for wounds of the skull and brain are followed by a shocking rate of mortality, and further, form a large proportion of the injuries received in warfare.

According to the report of the surgeon-general of the United States army for the year ending June 30, 1901, 305 soldiers of the United States army were killed in action in China and the Philippines. Of these, 78 (25.5 per cent) of those dying on the field had gunshot fractures of the skull, and, according to the same report, 94 per cent of all gunshot fractures of the skull resulted fatally.

In the Civil War, 57 per cent of all gunshot fractures of the skull were fatal. The fatalities from the same class of injuries in the Spanish-American War reached 64 per cent.

Wounds of the cranium during the Boer War produced an immediate mortality rate of 70 per cent (Hildebrandt). Of those men not dying on the field, about 50 per cent recovered under treatment, so that fatal results, either primarily or secondarily, occurred in 85 per cent of the total number wounded in this way.

Cases of injury by gunshot to the cranium reach the large proportion of about one to eight of the total wounded. This is about the average of the wars of the past forty years, but we may remark that during the Crimean War injuries to the head occurred in about twenty per cent of the wounded. This came about from the conditions under which the fighting was done; i. e., largely from intrenchments, at short ranges.

To appreciate the character of skull and brain wounds made by the modern small-caliber mantled projectile, we may quote the words of a recent observer, Baron von Wreden, of the medical corps of the Russian army, who says:

"All lesions of the cranial cavity inflicted at an approximate distance of 200 steps or less are absolutely mortal, on account of the distinctly expressed hydraulic and hydrodynamic action of the contents of the cranial cavity; at a distance up to 100 steps, the greater part of the roof of the skull is carried off, together with the integuments and the brain. Beginning at a distance of more than 200 steps, tangential shots admit recoveries, the number of which is proportionate to the distance from which the shot is fired.

"Perforating wounds of the cranial cavity, however, even when inflicted from a distance up to 1,000 steps, are generally followed by death.

"Only when inflicted beginning at the distance of 1,200 steps do fractures of the skull become perforating-hole fractures and admit recovery."

In experimental trials of the modern military rifle, made years ago, by Bruns, Coler, Schjering, Hobart, Chauvel, Nimier, Kocher, Demosthen, and others, with full charges, it was demonstrated that serious damage might be, and it generally is, caused at ranges up to 1,700 to 1,800 yards; beyond these ranges the effects of the bullet approach more nearly to those resulting from pistol-bullets of small caliber, such as are often met in civil practice. These are generally made at short range, when the velocity of the missile is about that of the rifle-bullet at long ranges.

The general opinion of those surgeons making observations during the Philippine, South African, and Russo-Japanese wars seems to be, that at short ranges, within 100 meters, the brain, bones, and scalp are blown away in mass, or the brain may be totally disorganized and the bones extensively comminuted, while still held together by the scalp; beyond 100 meters, and up to the distance of 1,700 to 1,800 meters, there is perforation, with comminution

[1] Read before the Chicago Surgical Society, December 7, 1906.

of bone around both orifices. From 1,800 meters upward to 2,700 meters, often occur clean perforations. At nearly and above 2,700 meters, penetration occurs, with lodgment of the bullet.

The normal — i. e., undeformed — bullet of the modern military rifle produces remarkable differences in effect on the skull and its contents, according to the remaining velocity of the bullet at the time of striking and its angle of impact on the bone. Further, atypical wounds are produced by bullets which have undergone deformation by ricochet.

The simplest division of gunshot wounds of the head that we can make is into two classes, the first of which includes those wounds which involve the scalp alone, or the scalp and the external table, without injury to the cranial contents.

Wounds of this class occur as mere grazes or as furrows, with actual loss of substance and consequent wide retraction of edges. On the flatter surfaces of the skull, as in the frontal or lateral regions, subcutaneous tunnelings with openings of exit have been observed. Such wounds should always be thoroughly examined for evidence of skull fracture. If such evidence be found, the case belongs to the more serious or second class, for where the outer and inner tables of the skull are separated only by diploë, injury of the outer table by a modern bullet without damage to the inner table must be excessively rare.

Injury to the outer table alone may occur over the frontal sinus or in the mastoid process; in the latter case generally resulting in paralysis of the seventh nerve, with deafness, produced either by direct injury to the auditory apparatus or by the effect of vibration. Where the contour of the skull is sharply curved, it is not likely that a modern bullet traveling at high velocity will inflict a grooving or tunneling wound without injury to the underlying bony structures.

Makins noted that in connection with gutter wounds and subcutaneous tracks crossing the forehead and sides of the head there were occasionally observed, in the absence of external fracture, such signs of intracranial disturbance as transient muscular weakness, unsteadiness in movements, giddiness, diplopia, loss of memory and intellectual clearness. In connection with such symptoms, the possibility of splintering of the internal table had to be borne in mind, but he saw no proven instance of such accident.

We may add that a splinter fracture of the internal table, without injury to the external table, is generally produced by a force acting at, or nearly at, a right angle to the surface, while in the cases under consideration the vulnerating force parallels the osseous surface.

A large proportion of scalp wounds caused by projectiles are, so far as life is concerned, of slight moment, but any wound, though apparently of the scalp alone, requires careful examination for possible fracture before a definitive dressing is made.

The second class includes injuries of the cranial bones with damage to the cranial contents.

Except in the situations before noted — i. e., over the frontal sinus and in the mastoid process — bone injuries without involvement of the brain are exceedingly rare.

During the Civil War a large number of injuries of the skull and its contents were due to the impact of spent leaden bullets of from one to one and a half ounces in weight. These, by reason of their weight, although traveling with low velocity, were capable of producing severe contusions, cerebral concussion, or even cerebral hemorrhage.

Injuries inflicted in this manner were frequently followed by suppurations, with exfoliation of bone from the outer table.

With the modern projectile, such effects are rare. Makins, from his large experience in South Africa, noted only one case of escape from injury of the internal table, with depressed fracture of the external table of the skull. On account of the presence of a typical wound of entry and the detection of depression at that point, the skull was trephined and no depression or splintering of the inner table was found.

Excluding cases immediately fatal, the most common injuries of the skull with implication of the cranial contents are what have been described as "gutter" fractures. These are produced by projectiles striking the skull at an acute angle to its contour and breaking up the

bone for some distance. These injuries have been described in three distinct varieties.

In the first variety there is fragmentation of the external table, with depression of the fragments toward the central line of the wound, with breaking up of the inner table into large, thin-edged plates, which are depressed onto the dura. These are described as V-shaped gutters.

In the second variety the depressed bone is narrow and depressed vertically, producing extensive fragmentation of the internal table.

The third variety is characterized by pulverization and carrying away of the external table in the track of the bullet, the internal table being comminuted, with more or less laceration of the cerebral membranes and substance.

These three varieties of tangential wounds furnish the largest proportion of recoveries, after gunshot fracture of the skull, as they are fortunately more frequent than perforating wounds or penetrating wounds, with lodgment, among those in which the injury is not immediately fatal.

Penetrating wounds of the cranium vary exceedingly as regards the amount of damage done to the cranial contents. The most severe of these wounds are the result of impact of bullets traveling at high velocity and striking the bone surface at a right angle. The orifice of entrance in the bone is slightly larger than the transverse section of the bullet, and may be circular, rectangular, with rounded corners, oval or pear-shaped, these variations being due to the shape of the skull at the point of impact. The edge of the opening in the bone is of the external table, the internal being invariably broken into fragments.

Fissuring of the bone around the orifice of entrance is seen frequently in wounds near the vertex, where the curves of contour are sharp, but is most extensive near the base. It is not generally extensive in the middle zone of the skull. It is in wounds of this character that the so-called "explosive" force is displayed. The consistency of the brain in the inclosing cranium leads to the production of the same phenomena which are observed in the passage of a missile at high velocity through a can of water. There is a forward and lateral transmission of force vibrations which wrecks the cerebral substance and the opposite side of the skull before the emergence of the bullet. The cinematographic experiments of Tillmanns show that at very short ranges there is an actual backward escape of cerebral tissue and *débris* from the orifice of entrance, while the bullet is still passing through the cranium. The aperture of exit in the scalp in these cases may be small relatively to the amount of destruction of the bone and brain tissue beneath it. This is extensive, the amount of disorganization of the brain and bone being proportionate to the velocity of the vulnerating missile. Such wounds in the region of the base of the skull are likely to be accompanied by extensive fissuring and to be followed by large extravasations.

Perforating gunshot wounds of the cranium made at long range — i. e., at more than 1,800 meters — on account of the comparatively low velocity of the bullet, usually make small, clean apertures of entrance and exit, with a certain amount of fragmentation of the inner table at the wound of entrance. The destruction of brain tissue is small in extent, being confined to the track of the bullet, and there is, as a rule, absence of the explosive effect noted in wounds inflicted at shorter ranges.

Penetrating wounds with lodgment of the missile occur at the longest ranges (2,700 m. and upwards), on account of the lowered velocity. In these cases the orifice of entrance is frequently somewhat larger than the bullet, possibly from wabbling of the latter as its rotary motion is decreased.

It is impossible in a paper of this length to consider many of the details of wounds of this region, or to cite remarkable experiences that have been reported by various writers on the later wars. From the reports thus far published and at hand, we can glean only general information. An immense amount of patient study and investigation, particularly of conditions found post-mortem, must be made before we attain exact knowledge as to the effects of missiles on the cranial contents, and furthermore, the question of primary surgical interference must be decided for the future by the results of study of large numbers of cases reported in detail.

TREATMENT

The difficulty of formulating lines of treatment will be realized when we consider the conflicting opinions that have been published as to the necessity or expediency of primary surgical interference in gunshot fractures of the skull, but we believe that the proper guiding principle, *so far as it can be followed in military practice*, is the application of the same rule which should guide us in civil practice in all wounds of emergency; that is, to put the patient in the best condition for recovery as early as possible after he has received the injury.

Fatalities, in a large proportion of those brought off the field alive, are due to infection. The aim of the surgeon, therefore, should be the prevention, or at least the limitation of action, of this lethal agent, for, while we recognize the impossibility of removing infection from the deep brain substance itself, we can by early interference provide for the outlet of its products.

All scalp wounds should receive the closest attention, and a thorough examination for possible involvement of skull contents. The area around the wound should be shaved, and, in cases of doubt, a semicircular flap, of which the wound should be the center, laid back, giving access to the bone surface and room for exploration should further exploration be deemed necessary. We need not here describe the details of cleansing of the scalp, but would insist upon the packing of any wound of the scalp before the beginning of cleansing operations, that infection may not be carried into the wound by the procedure intended to prevent it. The flap should be replaced and sutured, the bullet-hole being used for gauze or other drainage.

Gutter fractures should be invariably operated on as early as possible, to get rid of bone fragments, clot, and *débris*, and to provide outlet for the products of infection which is common to these cases. Without early operation these wounds suppurate, and then operation is too late. (Von Manteuffel.)

In transverse perforating wounds, cleanse orifices and await symptoms.

In superficial penetrating wounds with lodgment, exploration, with removal of bone fragments and bullet, should be made, if practicable.

In transverse penetrating wounds, cleanse orifice of entrance, await symptoms, and radiography.

Cases of compression by blood extravasation with localizing symptoms are rarely seen. When extravasation can be localized and is accessible, it should be treated on general surgical principles.

In some cases of penetration there may be fracture of the skull opposite the point of entrance, without exit opening. Such a condition requires exposure and removal of bone fragments. The bullet in such cases is rarely found near second fracture, generally having been diverted to some other region by ricochet on the skull-wall.

The question of removal of a bullet lodged in the cranium is one of special interest, inasmuch as a widespread belief prevails that a lodged bullet is, *per se*, a most dangerous thing. The danger lies in the damage done to the brain by the passage of the bullet through its substance, and, unless symptoms arise which can be traced to persistent irritation by the presence of the bullet, or radiography demonstrates that the bullet is in a position, sooner or later, to produce irritation, no attempt should be made to remove a deeply seated bullet from the cranial cavity. Whenever we are confronted by the question of removal of a deeply lodged bullet, it should be definitely ascertained that the symptoms present are due to irritation from the presence of the bullet itself, and not to its having inflicted damage on certain regions of the brain on its way to its present location, for the removal of the bullet could in no way affect the injured cerebral tissue.

Bullets deeply imbedded rarely give rise to special symptoms. Superficially (cortically) seated foreign bodies should be removed early.

PYELONEPHRITIS OF PREGNANCY[1]

By CHARLES B. REED, M.D., Chicago

A DISEASE so infrequently reported and so liable to be overlooked or misinterpreted as pyelonephritis demands that a *résumé* shall be made of its most salient points, together with some discussion of its present status that shall serve to emphasize its importance to obstetricians as a specific accident of gestation, and to call attention to some of its most positive manifestations.

During recent years, several series of cases have been published, of which the largest is by Opitz, who collected 84 cases from the literature. From a study of this collection he decides, in harmony with French, English, and with other German authors, upon an ætiology which is generally accepted, apparently, by the authors of text-books and approved by journalistic writers.

This ætiology assumes the presence of a urinary stasis, determined by the compression of the ureter by the growing uterus primarily, to which is added an infection by micro-organisms through systemic channels, or by ascent from the lower urinary passages.

Such an explanation is very attractive, and highly important if true, but the theory is open to many objections — too many, indeed, for acceptance without thoughtful revision.

The occurrence of ureteral compression cannot be definitely denied as a possibility, yet one can hardly receive it without skepticism. This phenomenon has been a great favorite among medical writers for half a century, and especially some years ago as an important ætiological factor in eclampsia.

From this citadel it has been recently driven, only to be given a new home under the roof of pyelonephritis; an appearance for which there is just as little reason as there was for the assumption, popular for many years, that compression of the urethra by the retroverted pregnant uterus was responsible for the bladder injuries in that gestational complication.

If pyelonephritis occurred solely in pregnant women, or solely even in females, it would appear more rational, but its presence in males disposes absolutely of the necessity of considering a stasis by ureteral compression as essential to the ætiology.

The disease appears occasionally before the fourth month of gestation, when ureteral compression by the uterus is, to say the least, highly improbable; and in the rare puerperal cases even Vinay feels obliged to abandon the compression idea, and to assume the presence of crushing injuries and hyperæmia due to the labor.

If the theory is correct, ureteral compression would be far more common, and a resultant pyelonephritis much oftener encountered, not only in simple pregnancy, but also where fibroid or ovarian tumors of large size exist, or in twin pregnancies. The statistics, however, do not show that pyelonephritis is unusually frequent, but is, on the contrary, extremely rare in such individuals.

It is strange, too, that compression should occur at a certain definite time, and suddenly, as a rule, with a duration of only two or three weeks, when, for months before or after, the conditions are probably just as favorable for an attack.

It is also pertinent to inquire if a double pyelonephritis is to be explained by stasis arising from simultaneous compression of both ureters by the same uterus. If compression is possible, it is not unreasonable to expect the event to occur and be followed by pyelonephritis, not only frequently in the same pregnancy, but even continuously throughout that pregnancy.

It has been urged, also, that an anatomical anomaly, such as a long bend or curve in the right ureter, and its consequent removal from the protection of the promontory, or "kink" where the ureter passes over the iliac artery, would explain not only the possibility of compression but its infrequency. Without denying such an anatomical condition, the question arises, whether, under such circumstances, ureteral compression should not logically occur in every pregnancy of such an afflicted patient,

[1] Read before the Chicago Gynecological Society, November 16, 1906.

or even repeatedly in the same pregnancy, and result in many attacks of pyelonephritis.

To one who realizes how much force is necessary for the ureters to drive drop after drop of urine through their vesical openings into and against the constantly increasing resistance of a greatly overdistended bladder, the possibility seems very remote that the ureter can be compressed enough to produce stasis by the mere weight of any abdominal organ, or by an enlarged uterus, and if such a compression did occur, necrosis would of necessity follow.

If stasis alone, plus bacterial invasion of course, results in pyelonephritis, how is it possible for the patient to have one ureter entirely occluded by a stone while the surgical interference two or three weeks later reveals nothing but the stone and a large hydronephrosis?

It is certain that some condition is present, other than stasis, or even the stasis plus the bacillus coli which is usually found. Indeed, the presence of the bacillus coli is relatively unimportant as a finding, inasmuch as this germ may have followed and destroyed any possible antecedent micro-organism.

The fact that the disease is more common on the right side (50 cases out of 63 in one series) has apparently no ætiological significance, but should be regarded as an accidental phenomenon similar to the greater frequency of floating kidney on the right side or the infection of the left Fallopian tube.

Before closing the subject of ætiology, it is only fair to state my own hypothesis as to the origin of this disease and the reasons that make the hypothesis seem plausible. Thus, pyelonephritis may be regarded as a distinct disease of gestation, due to degenerative changes in the renal epithelia and parenchyma, resulting from the transudation or excretion of the toxins of pregnancy through the kidney tissues, plus bacterial invasion, probably of vesical origin. The character of those degenerative changes should be such as accompany the "pregnancy kidney" (von Leyden), but of greater degree. Pathologically, one should find the renal epithelia, and eventually parts of the parenchyma, undergoing a fatty infiltration.

In pyelonephritis, as well as in "pregnancy kidney," there is to be found more or less suppression of urine coming on in the latter half of gestation, accompanied by albuminuria and cylindruria, which ultimately, in the former, becomes a pyuria with general toxic symptoms. In both cases, relief rapidly follows the emptying of the uterus. There is reason to believe that pyelonephritis may be the result of toxic changes (plus bacteria), which would class it as an extension of the changes found in "pregnancy kidney," and that further extension of the process might result in eclampsia.

In one case of my own, there was definite suppression of urine on the right side on the third day of the disease, as shown by the Harris segregator, and yet the nephrotomy done eighteen hours later revealed no accumulation of urine in the pelvis of the kidney, and the ureter was patulous, uncompressed, and capable of conveying colored fluid to the bladder after the operation.

In support of the above hypothesis, an analogy might be found, also, in eclampsia, since the time of the attack in both can be easily associated with the period of greatest toxicity, and the early as well as the puerperal cases plausibly explained.

A certain percentage of the cases recover and are delivered at term, while others are confined prematurely, in consequence of the severity of the attack, which is also true of eclampsia. Another parallelism may be found in the relief experienced in both diseases by the emptying of the uterus.

It may be urged against this procedure that one hypothesis is used to prove another, but that the cause of eclampsia must be sought in toxæmia seems almost on the point of demonstration.

With the ætiology by no means so well settled as the literature would indicate, one turns with relief to the presence of definite symptoms upon which a diagnosis can be based. The onset, occasionally insidious, usually begins with a chill, followed by pain in the abdomen and side (right?), nausea, vomiting, and headache. The fever rises to 101° or 104° F. in the evening, with morning remissions. The chill may recur. The pulse does not correspond to the fever curve. The pain becomes more localized on the side, usually the right, and radiates to kidney and hip, with tenderness over McBurney's point and over pelvis of kidney; worse under pressure. Urination may be painful, although

the bladder is not tender upon palpation. Patient is usually constipated, or has foul stools. The ureter sometimes may be felt as a thick cord, and after a few days the kidney may show enlargement, with tenderness and muscular spasm over it. Urinalysis gives an acid reaction, quantity diminished, appearance cloudy, with albumin and white and red cells and bacteria (bacillus coli).

The use of the cystoscope and the catheterization of the ureters greatly facilitate the diagnosis; and if only one kidney is affected, it is thus readily differentiated from the healthy one. There is only a small amount of albumin in the urinary filtrate if the inflammation is limited to the pelvis of the kidney, while the pressure of a large amount of albumin signifies disease of the parenchyma, and there is an absence, of course, of the cylindroids and the epithelia from the pelvis of the kidney.

Epithelia from bladder and upper urinary passages are highly diagnostic, of course, when found. As the quantity of urine increases, the conditions improve. The chill, pyuria, absence of bladder symptoms, and the presence of kidney pain and enlargement, are the principal points; appendicitis must be excluded. It cannot be confused with cystitis if any care whatever is exercised.

The course of the disease is somewhat variable. It is usually self-limited, with a period of about two or three weeks. Recovery is prolonged in many cases, but life is not usually endangered, although death does sometimes occur. The labor may be prematurely induced by the attack, or rendered more difficult by the bodily weakness.

The prognosis is not favorable for the child, since premature labor, either spontaneous or artificial, occurs in about 55 per cent of the cases. Not more than 40 per cent of the mothers can be expected to recover and go on to normal delivery at term.

The treatment of the attacks has been either surgical, medicinal, or obstetrical, alone or combined. Surgery is ineffectual, and does not reach the conditions; besides which, a mortality of 17 per cent for nephrotomy would contraindicate that measure in all but a very few selected cases, if not altogether. The aim of treatment should be to relieve the pain, support the powers of life, and combat the infection. Dorsal position in bed. Milk or other bland diet, with mineral waters freely. Bowels kept empty, and urinary antiseptics comprehend the most useful measures.

Urotropin in large doses, or quinine, salol and boric acid, two grains each, four times a day, to destroy the bacteria in the urine. Morphine for the pain, and strychnine if necessary, constitute the medical essentials.

The question of obstetrical interference is bound to arise, and must be decided by the findings in the individual cases. In general, it is not necessary. However, it is certain that some cases will die unless the uterus is evacuated, and the interference must not be postponed until the patient's chances are too seriously diminished. The maternal rights are paramount, and must be preserved.

COOK COUNTY HOSPITAL

Department of Pathology

TUBERCULOUS PERITONITIS IN THE FEMALE

By ADDISON BYBEE, M. D., Chicago

Demonstrator of Pathology, Medical Department, University of Illinois; Pathologist to the Illinois Northern Hospital for the Insane, Elgin, Illinois

A STUDY of the last 872 autopsies at the Cook County Hospital shows 30 cases of tubercular peritonitis. Of those cases which showed tubercular peritonitis, 28 were in the male and 2 were in the female. Of the 872 autopsies, 753 were male. This gives a showing of tubercular peritonitis in a little more than 3.7 per cent. Of the 119 female subjects, 2 showed a similar infection, or a little less than 1.7 per cent of the entire number of females posted. This shows a relative proportion of 2.2 males to 1 female.

This is surprising, in view of the fact that surgeons and gynecologists generally find peritoneal tuberculosis so much more prevalent in the female. The Mayos find it four times as frequent in the female as in the male, and Osler finds the statistics from a similar source showing a relation of 131 females to 60 males.

Reference to the literature on the subject shows that Virordt found 80 per cent in the male; Sick, 83.1 per cent in the male; Cummins, 67.3 per cent in the male. An average of the findings of these three observers shows a proportion of a little more than three males to one female.

There is a seemingly flat contradiction between the findings of the first and second groups of observers, but inquiry into the source of their figures shows that the first group are clinical or operative observations, while the second are post-mortem findings. The frequent pus infections and various pelvic derangements in the female bring her so much more frequently under the care of the surgeon than the male, and it so frequently happens that the operator finds a tubercular peritonitis where he thought he was dealing with the more common pelvic disorders, that it seems that this feature would help to explain why the surgeon sees more of such cases in the female than in the male.

Since the figures show that tubercular peritonitis is two to four times as frequent in the male as in the female, it is allowable to conclude that possibly the genital tract is not a route of infection.

Dr. W. A. Evans finds that seventy per cent of all peritonitises disease is purulent, twenty-five per cent tubercular, and the remaining five per cent is due to bacterial leakage, and that in the first group the female far surpasses the male in frequency, by reason of her pelvic infections (pus-tubes, gonorrhœa, parturition, etc.), and he states that "if in the twenty-five per cent group we were to assume that the female was equally liable (with the male) to contract tubercular peritonitis through her gastro-intestinal tract, gall-bladder, and appendix vermiformis, we would be justified in contending that her genital apparatus protects her in some measure against this infection." In fact, the figures given above plainly argue that:

1. The female peritoneum is relatively immune to tuberculosis.

2. Infection of the peritoneum through the genital tract is rare, or never occurs, at least not with computable frequency, but it is possible to be misled by figures.

What evidence is there of infection by the genital route?

1. We have found 1.7 per cent of the 119 autopsies on females at the Cook County Hospital to have tubercular peritonitis.

2. Scram, in 3,386 necropsies on women, found genital tuberculosis in 34. J. Veit, in 7,000 necropsies, found 450 tubercular women. Of these, 18 suffered from genital tuberculosis. Thus we find that genital tuberculosis is very rare.

If 1.7 per cent of all autopsies on women show peritoneal tuberculosis, and only 1 per cent shows genital tuberculosis, there is an association of the two conditions in a little over one half of the cases.

If the genital tract is an important factor in tubercular peritonitis in the female, as it is in the suppurative type of peritonitis, we would properly conclude that there is an ascending infection. This does not seem to be the case. In the pus cases, in the infection with the gonococcus for example, there is:

1. A vulvitis.
2. A vaginitis.
3. An endocerviscitis.
4. An endometritis.
5. An infection of the Fallopian tube.

In genital tuberculosis, according to the authors, it is the other way around, the upper portion of the genital tract being more frequently affected. Dr. J. B. Murphy states in his monograph on "Tuberculosis of the Female Genitalia and Peritoneum": "This [tubal tuberculosis] is by far the most frequent variety of genital tuberculosis, and is usually bilateral. The fundus uteri is most frequent after tuberculosis of the tubes." "Cervical tuberculosis is very rare, and seldom combined with tuberculosis of the fundus. Thus Späth, in his 119 cases of uterine tuberculosis, found the cervix affected only 6 times. Wasmer, in 6 cases of uterine tuberculosis, reports the cervix free from disease. Vaginitis is usually found in association with similar lesions in the upper genital tract; it has, however, been discovered in several instances to be the only site of tuberculosis in the genitalia. There seems to be but one case of primary tuberculosis at the vagina; that of Bierfreund." Vulvitis is the most frequent form of genital tuberculosis. In fact, it is so rare that Späth was unable to find a single case of primary tuberculosis recorded in 1885.

It does not, then, seem reasonable to assume that peritoneal tuberculosis is due to an ascending infection in the genital tract. In fact, P. Baumgarten found by experiments on rabbits that there was no reason to assume that there was an ascending infection. He repeatedly infected the genital tract of the rabbit at different levels with tubercle bacilli, and found that while tuberculosis might spread by continuity to other structures, so far as the genital tract was concerned a subsequent infection was always at a lower level, and never upward. He says: "The infection always extends downward to involve upper vaginal segment," and further, "A so-called ascending extension of the tuberculosis infection was never observed. Since, then, tubercular infection of the genital apparatus in the female is most frequent in the upper extremity, and there is little or no evidence of ascending infection, it would seem reasonable to assume that the tube may readily be infected from the peritoneal cavity. The experiments by Pinnar show that inert particles may be recovered in the lumen of the tube and the mucosa of the genital tract after injection into the peritoneal cavity. Osler cites Jani as having observed tubercle bacilli in the lumen of the Fallopian tube of a women dead of pulmonary and intestinal tuberculosis, and he suggests that the cilia lining the tube tends to attract particles introduced into the peritoneal cavity. Dr. Murphy found among his clinical cases that the tube in tubercular cases uncomplicated were opened at their abdominal ostium, but in cases complicated with a mixed infection the fimbriæ were matted together, closing the ostium.

These facts point to the tubes as a possible exit for tubercle bacilli that have found entrance to the peritoneal cavity in moderate numbers, bearing out our contention, based upon the preceding figures, that the female peritoneum has a rather marked degree of immunity to tubercular peritonitis over that of the male.

Mas, Cullen, Dudgeon and Ross, and Buckston, experimenting on the absorption from the peritoneal cavity, found that the flow was towards the diaphragm, and through the diaphragm and into the anterior mediastinal space, as well as a deposit of material upon the omentum and in the upper abdominal organs. They, however, experimented with inert material and moderate infections with the typhoid bacillus, bacillus anthrases, streptococci and staphylococci, all of which has little or no bearing on this subject, because they were dealing with doses of bacteria that the peritoneal drainage and phagocytosis could control. Drs. Evans and Murphy, experimenting upon the peritoneum of monkeys, used massive infections, and found that phagocytosis was paralyzed, and that the tubercle bacilli under such conditions gravitated into the pelvic peritoneum. They found the pelvic viscera matted together, and that the bulk of infection was below the

umbilicus. They did not find that the infection had entered the ostium abdominale, and that the genital mucosa was free from tubercular infection, and that the fimbriæ were matted together, probably as a result of the massive dose of the tubercle bacilli.

If a pus infection of the peritoneum from the genital tract take place, the infection is an ascending one. Such a condition in genital tuberculosis P. Baumgarten's experiments prove is not paralleled. Pus does not normally travel in an upward direction, but outward, and will always travel outward unless there is an obstruction to its exit. The genital tract in peritoneal tuberculosis is open in uncomplicated cases, and leaves no excuse for an ascending infection. In the bronchi we know that so long as the ciliated epithelium is intact, tubercle bacilli do not find lodgment in the mucosa, but when the mucosa is traumatized from any cause, and the integrity of the epithelium is involved, the tubercle bacilli that gain access to this area are able to grow rapidly.

In the genital tract the mucosa is often involved by reason of the frequent pus infections. This furnishes a favorable soil for the lodgment and growth of the tubercle bacilli that Jani finds draining off from the peritoneal cavity, and thus we have the genital tract infected from the peritoneal cavity by a descending infection, rather than an ascending infection.

CONCLUSIONS

1. Peritoneal tuberculosis is two to four times as frequent in the male as in the female.

2. The genital tract of the female is not a factor in the ætiology of peritoneal tuberculosis.

3. The genital tract of the female furnishes a degree of immunity to peritoneal tuberculosis above that of the male.

COOK COUNTY HOSPITAL

Department of Surgery

ABDOMINAL GUNSHOTS

By E. C. RIEBEL, M. D. (Cook County Hospital, 1902), Chicago
Instructor in Surgery, Northwestern University Medical School; Surgeon to People's Hospital, Chicago

AMERICAN surgery justly claims the credit of putting the treatment of penetrating gunshots of the abdomen occurring in civil life upon a rational and logical basis. Through the work of Nicholas Senn, T. Bull, W. W. Keen, and others, we know that the correct treatment of this variety of injuries lies in early operative interference. In consequence, a difference exists now between the *modus operandi* employed in the field-hospital and that in civil life. The change in the character of projectiles in military practice still further increases this difference, as the reports of the late wars show.

The high-velocity metal-jacketed bullet of modern warfare produces beyond the zone of explosion much more benign effects than the old lead bullet of larger caliber. While within the zone of explosion (1,200 yards) the results are more disastrous even than formerly, yet at a longer range the action of the bullets produces a cleavage rather than destruction of tissues. Intestines, as well as vessels, may evade the bullet, or may deflect the tip from its course. Slits in a comparatively empty gut may close spontaneously.

The revolver, the weapon most frequently used in civil life, is a crude weapon in comparison with the rifle. The initial velocity of the revolver-bullet is about half or even less than half that of the rifle. For example, a 38-caliber Smith and Wesson has an average of 820 feet velocity, bullet 0.360 diameter, while the 30-caliber United States government rifle has a velocity of 1,960 feet, bullet 0.308 diameter (metal-cased). In consequence, the revolver-bullet has less power of penetration and greater tendency to deformation. To these is added a considerable amount of explosive action, occasioned by the short range at which most of the shots are fired.

The results produced resemble, in a moderate degree, more those of the shrapnel, and may be summed up as follows:

(*a*) The wounds bear the character of a contusion.

(*b*) Considerable skin particles may be carried into the wounds.

(*c*) Portions of clothing are frequently introduced.

(*d*) A wound of exit is rarely present. The bullet remains in the organ or lodges under the skin. Evasion of abdominal contents is exceedingly rare. Effective spontaneous closure of gastro-intestinal wounds scarcely ever occurs.

Injection. Two varieties come into consideration with these cases: (*a*) External; (*b*) Internal.

In general, it must be conceded that the track of the bullet is infected. (Gessner, Lagard, Habert, Faulhaber.) If primary healing occur, as is the case with the majority of gunshots of other regions, we must attribute it to the natural means of defense of the body, and not to an aseptic bullet. The virulence of the infection is a modifying factor. Tavel (1) has proven that particles of clothes found within the shot-canal harbor pathogenic micro-organisms which are liable to cause infections.

The introduction of minute particles of dead skin into the wounds has been mentioned above. With these, saprophytes and pus-germs are scattered throughout the canal, while the fine particles of dead skin furnish good culture material.

Experiences reported from the late Russo-Japanese war show that shrapnel wounds treated similarly to rifle injuries by mastic dressing, applied immediately after injury, suppurated unusually frequently, while the rifle injuries healed by primary intention.

Extravasation of gastro-intestinal contents is the chief source of internal infection, while the other secretions and excretions are of less

importance primarily. The destructive action of pancreatic juice upon the fatty tissue within the abdomen is well known. Bile and urine produce a chemical peritonitis without secondary infection, while with external infection a general septic peritonitis ensues.

The liver, or, better, its bile-ducts and portal capillaries, may give rise to internal infection stronger than that carried in from without. Langenbuch (2) states emphatically that the blood in the portal vein is the most impure in the body. Terrier and Auvray have confirmed this. Suppuration is known to have occurred in subcutaneous wounds of the liver. This process may best be compared with acute infectious osteomyelitis. Infectious material circulating in the blood shows a predilection for places with lessened resistance (trauma).

Dependence upon natural protection, such as the "celebrated infected mucous plug" (Lejars, 3), the covering of perforation by omentum, or by adhesions of neighboring coils of intestine, is hazardous and extremely uncertain.

SYMPTOMS OF ABDOMINAL GUNSHOTS

It may be said, in general, that there is no proportion between the general symptoms and condition of the patient and the severity of the lesion within the first few hours, except in the most fulminant cases. Shock, pain, vomiting, acute anæmia, are the general symptoms which abdominal gunshots share with abdominal injuries of different origin.

Shock. If we understand by this the reflex paralysis in the sense of Goltz, the majority of the cases observed did not show it at all. If present, it exhibited a marked degree of evanescence, or was quite amenable to the usual methods of treatment. It appears as if the shock observed in intra-abdominal lesions resembles more that associated with crushing injuries of the extremities, inasmuch as it is based upon definite anatomical lesions. When present, we may assume that definite lesions exist which are the cause of this shock.

There is, perhaps, the same relationship between pure abdominal shock (reflex paralysis: Goltz) and abdominal lesions as between the so-called cerebral concussion and cerebral contusion. Both shock and concussion are characterized by their fugacity, while persistent or progressively increasing symptoms point to definite anatomical lesions.

In the twenty-eight cases of abdominal gunshots observed, the following was noted:

No Shock

(As indicated by general appearance, pulse, temperature, respiration)

1. Liver, lung.
2. Liver.
3. Descending colon.
6. Kidney, liver, lung.
8. Descending colon.
9. Transverse colon, cæcum, stomach (abrasion).
10. Bladder, small intestine, rectum.
12. Liver, kidney.
13. Small intestine.
14. Liver, transverse colon, small intestine.
15. Stomach, liver.
16. Stomach.
17. Transverse colon.
18. Bladder.
19. Bladder, small intestine.
20. Spleen, kidney.
27. Spleen.
28. Non-penetrating.

In these eighteen patients, who were admitted to the hospital from one to two hours after accident, reflex paralysis, if present immediately after the accident, had disappeared or was not present at all, as in case 2. This young woman walked down three flights of stairs to summon aid after the shooting.

Marked Shock

7. Stomach, liver.
11. Stomach, lung.
23. Small intestine, 8 perforations; lung (also great hemorrhage).

Moderate Shock

4. Bladder, small intestine.
22. Transverse descending colon.

Patient 26 showed pronounced and immediate symptoms of reflex paralysis. He fell immediately after shooting. When seen ten minutes later, consciousness had not returned. Pupils, widely dilated, did not react to light. Corneal

and other reflexes absent. Pulse rarely palpable. He rallied, however, within forty-five minutes, to succumb later to extensive hemorrhage.

Symptoms of Collapse Referable to Hemorrhage

5. Bladder.
24. Liver, portal vein, descending colon.
25. Branches cœliac axis.

Pain. Was present in the majority of cases. Nothing characteristic, however, can be said about its intensity or location. Referred pain, such as pain sensations in the right shoulder or scapular region, indicating an injury to the liver, was not observed in any of the liver shots. Hyperalgesic zones (Head) which might lead to diagnosis of the seat of injury were not observed.

Vomiting. Early vomiting, so important a symptom in subcutaneous injuries of the upper portions of the gastro-intestinal tract, was not present as regularly as expected. It occurred in fifty per cent of the four perforating wounds of the stomach. Vomiting occurred ten or twelve hours after injury in case 9 (abrasion of anterior wall of stomach, three colon perforations), but was due to beginning peritonitis. It was present in five per cent of intestinal injuries and those of solid viscera.

Signs of Internal Hemorrhage. The cases in which these were present have been mentioned above. In a number of the other cases, blood was present to a variable amount in the peritoneal cavity, and venous hemorrhage still in progress without any outward symptoms. This confirms the observations of some writers that hemorrhage, especially venous hemorrhage, may persist for hours without characteristic outward signs.

Special Symptoms. The most striking symptom found present in the twenty-seven cases of penetrating gunshots was abdominal rigidity, or, better, muscular defense. (Hartman, Trendelenburg.) In many it was most marked over the site of the lesion, while in others it was more general. The pathognomonic character of this symptom proved of special value in differentiating between lesions of the chest and its organs and the combined injuries of pleural and abdominal cavities. Case 7 furnishes a good example. Entrance wound sixth interspace between mamillary and anterior axillary line. Position of assailant: size not known. Vomiting not present. Muscular defense was the only symptom pointing to abdominal lesion. It was marked over the left side of the abdomen, and persisted even after patient was fairty under the anæsthetic.

Dullness over Abdomen. Freely movable fluid was observed but twice (cases 24, 26). Usually a slight dullness was noticed in the flanks, which was ill defined, and hardly influenced by posture, despite the fact that more or less considerable quantities of blood were found at operation. The reason for this apparent deviation from the physical signs elicited in ascites lies probably in the character of the fluid and the anatomical conditions. A certain amount of the blood collects in the small pelvis. A persistent contraction of the loops of small intestine was noted in all cases of intra-abdominal injuries; most marked in lesions of the intestines. The gut had a pinched appearance. The syrupy fluid collects between the loops of contracted intestine, and is held there. Often the omentum slips over the site of injury.

In injuries of the mesentery and mesocolon a portion of the blood gravitates along retroperitoneal channels, a small amount, only, reaching the free peritoneal cavity. In hemorrhage from the liver or spleen, the blood often collects between colon and parietes. The viscid fluid moves but slowly over the colon with change of posture, owing to its fixed position, while the remainder disposed of in the way mentioned does not suffice to give definite physical signs. Clots and fluid retained at the uppermost side still produce dullness. The influence of the character of the fluid upon the production of the signs was clearly shown to me in a case of subcutaneous rupture of the upper ileum. Large quantities of fluid ingesta had found their way into the abdominal cavity, through the rent. Hemorrhage was absent. Here the fluid moved almost with the precision of ascites. The increased specific gravity of the gut when perforated adds another factor to those already mentioned.

Tympany. Presence of air was not observed, either before or at operation. In two cases where tympany was present, it was due to a beginning peritonitis.

Pneumothorax. Was observed once in a combined lesion.

Type of Respiration. Costal respiration was more pronounced in purely abdominal lesions, while in combined lesions, abdominal breathing seemed to be in preponderance.

Diagnosis. Muscular defense appears, so far, to be the best sign to indicate the entry of a bullet into the abdominal cavity. Injury to the peritoneum brings muscular defense. It does not indicate whether a viscus is injured or not. Penetration, however, in the overwhelming majority, means perforation. The percentage given by some writers is ninety-five per cent. In our cases, one hundred per cent of penetrating gunshots were perforating.

Organ Injured. This is, in a good many cases, a matter of conjecture, both on account of lack of pathognomonic symptoms, as well as uncertainty about the course of the bullet. In the cases of injury to kidney or bladder, a positive diagnosis was possible by demonstration of blood in the urine, excepting one (case 21).

Pathological Anatomy. Marked burns about the wound were observed once. A wound of exit was not observed in any case. Deformation of the bullets in the majority consisted of a more or less flattening at the tip. In a few instances, the missile was greatly deformed. Caliber ranged from 0.22-0.44. Revolver was the weapon used in all cases but one (0.22 rifle). One of the 28 abdominal gunshots was non-perforating; 15 cases presented multipled injuries.

Organs Injured

(*a*) Solid viscera:	
Liver	10
Spleen	2
Kidney	4
(*b*) Hollow viscera:	
1. Stomach	4
Stomach abrasion	1
2. Small intestine	6
Large intestine	6
3. Bladder	5
(*c*) Vessels, mesentery	2
(*d*) Rectum	1

Liver Injuries. The wounds had the form of canal up to great stellate ruptures, affecting part or entire lobe; measuring, in case 24, nearly three inches across. Here the under surface was chiefly involved. The portal vein was torn about one third of its circumference. Similar lesions of stellate character were found in case 26, affecting convexity and posterior surface.

Large, gaping veins in the liver tissue were observed in both cases. In case 2, the wound affected chiefly the margins of both lobes, representing a deep groove with ragged contused edges. In case 7 the bullet was found in the center of the right lobe, with extensive destruction of tissue in the vicinity. The gall-bladder was not injured in any of the cases.

Spleen. The upper quarter of the spleen was destroyed *en masse* in case 20. No shot-canal discernible. A tangential shot (case 27) affected the convexity and produced a slight groove in a second case.

Kidney. Lesions were extensive in cases 20 and 6. Hydrodynamic action was marked. In case 21, wound was represented by a straight canal running in anteroposterior direction.

Stomach. Case 7 showed the largest perforations. They were located in the fundus, a little above the level of the cardia. The perforations were situated a little below the cardia in case 11. Once the bullet remained in the stomach (case 16). Extravasation of gastric contents occurred once. Once (case 9) the serous surface alone was injured, showing a lesion the size of a dime two inches to the left of pylorus. Large vessels were not involved in any case.

Intestines. (*a*) Small. The perforations ranged in numbers from 2 to 8, affecting in the latter (case 23) about two feet of intestine. The size of the perforation corresponded usually to the size of the bullet. They were, as a rule, close together. The wounds were always in the free portion of the gut; the mesenteric portion was never affected. The state of contraction of the gut has been mentioned above. Extravasation of fæces was the rule.

Colon. (*b*) Destructive action of the bullet was, in most cases, severer here than in the small intestine. The mesenteric border was often affected, with more or less injury of the mesocolon and formation of a hæmatoma of varying size. The extent of the lesions was at

times hard to determine, owing to the hidden location at the attached border. The wider attachment of the mesocolon and the appendices epifloicæ still increased the difficulty. These conditions were marked in case 23. Bullet passed through the omentum and mesocolon, splitting the latter to the extent of one half-inch. It appeared at first as if two perforations corresponding to the size of the bullet were present. Upon clearing away the fatty tissue in the mesocolon, a defect involving a quarter of the cæcum fissure was discovered. The ball had struck the colon at a tangent. (Entrance at umbilicus; passed diagonally to transverse colon, near cæcum). Tangent shots were more frequently observed in the colon. The fact that most of those shots were fired from the side and the comparative immobility of the colon account for this. Extravasation of small particles of fæces was the rule. There was no attempt at closure. The bowel was flabby in the region of the injury, and the defect gaped. Oozing from wounds in mesocolon was found frequently, and in some cases was quite extensive.

Bladder. A tendency to contraction was noted in all bladder wounds, not approaching, however, a closure. In two instances (cases 10 and 14) the bullet entered from behind, penetrating the iliac bone and wounding the rectum in one (case 10). In case 4, the bullet lodged in the bladder. Double perforations took place in cases 10, 23, and 19. In cases 5, 23, and 19, the bullet entered in front, pointing under the skin at sacro-uratic foramen in cases 5 and 19. In a later case splintering of ischium occurred. In one (case 5), the injury was entirely extraperitoneal. Small intestine was simultaneously injured in three (cases 4, 10, and 19). In all cases the perforations were small, and no sign of hydrodynamic action was apparent. This, together with the comparatively small amount of urine found in abdomen, proves that the bladder was comparatively empty at the time of the accident.

Omenta — Vessels. Extensive destruction of gastrocolic omentum with profuse hemorrhage not complicated by any other injury was observed in one case, while injury of a large vessel (portal vein) was also encountered in one case.

Combined Injuries to Pleural and Abdominal Cavity. A distinction between gunshots above and below the umbilicus has always been made by surgeons. At all times the graver prognosis of injuries in the upper abdomen has been pointed out. The development of the surgery of the special organs — spleen, kidney, liver, stomach — and that of the lung and pericardium, and even of the heart, has attracted the attention more to injuries of this class. The main points of difference in these injuries are the following:

1. Multiplicity of lesions.
2. Difficulty of ascertaining course of bullet and of diagnosis of lesions.
3. Frequent difficulties of access to lesions.
4. Complications.

The possibility of multiple lesions in this territory is a consequence of the anatomical conditions. The subpleural space contains the liver, stomach, kidneys, pancreas, spleen, while above the diaphragm both pleuræ, lung, and pericardium are in close proximity. The relations of pleura to pericardium are variable, so that in rare cases the pericardium may be injured in the fifth or sixth interspace at the border of the sternum without involving the pleura. The lower border of the pleura corresponds to a concave line passing downward from the tip of the ensiform cartilage, crossing the ninth rib in the midaxillary line, terminating behind at the center of the twelfth dorsal vertebra. The lower border of the lung descends during quiet inspiration to the upper border of the seventh costal cartilage in the mamillary, upper border of seventh rib in midaxillary, and to the ninth rib in scapular line. The vault of the diaphragm is somewhat lower on the left than on the right side. The descent of the diaphragm during respiration varies between one and two inches, and depends partially upon the state of repletion of stomach and intestines.

The highest point of the diaphragm during forced expiration corresponds to the fourth costal cartilage. Thus a bullet entering under such conditions at that point or its level may still inflict an abdominal injury, while, during forced inspiration, entry in the fifth or sixth interspace may produce chest injuries alone.

This is well shown in case 13, where the bullet entered in the fifth left interspace mid-

axillary line, passing horizontally through both lower lobes, without injury to diaphragm. The course of the bullet seems in some cases to be spiral. Only the consideration of the incessant play of the diaphragm and the organs below it enables us to conceive that at the time of injury the canal presented a straight line. We know to-day that in the majority of so-called contour shots (i. e., bullet following course of ribs or passing around abdominal wall) the body, at the time of shooting, was in such a position as to make a straight line between entrance and exit.

The combined type of injury occurred nine times in this series. The following lesions were encountered:

1. Pleura, lung (right), diaphragm, liver.... 1
2. Diaphragm, pleura, liver, lung, kidney ... 6
3. Pleura, lung, diaphragm, stomach, liver .. 7
4. Pleura, lung, diaphragm, stomach.....11
5. Pleura, lung, diaphram, liver, colon, transverse small intestine 14
6. Pleura, diaphragm, spleen, kidney.....20
7. Pleura, lung, diaphragm, liver, kidney....21
8. Pleura, lung, diaphragm, liver, diaphragm, lung.....26
9. Pleura, diaphragm, spleen 27

Conditions are more complicated on the left side, because more organs are apt to be involved. The more diagonal the direction of the shot, the greater the number of organs injured. A downward course of the bullet increases the number of lesions still more. (Case 14.) Injuries are not confined to the path of the bullet. Explosive action, especially disastrous in such a small space, may produce changes in the organs remote from the shot-canal. Wounds of the mucosa of the stomach without external lesions have been reported. In some instances they have led to fatal hemorrhage (Guinard, Lariboisière Hospital, cited by Moynihan; abdominal operations), while in others, development of ulcers followed. Necrosis of portions of liver and spleen not directly affected have been observed (König, 4).

Langenbuch attributes this to contrecoup. The patient who has successfully escaped the immediate dangers of combined injuries may still, and frequently quite late, succumb to complications. Suppurative processes may ensue above or below the diaphragm. Of these, subpleuric abscess is the most dangerous. It was met with once in this series (case 6). In another case it was strongly suggested (case 2). Complications above the diaphragm may consist of pleural effusions, serous or purulent traumatic pneumonia, lung abscess (primary or secondary, from subpleuric suppuration), lung gangrene. This latter I observed in one case (Dr. Schroeder, Wesley Hospital) of combined injury to lung and liver. In cases where the pericardium is involved, adhesive pericarditis may follow, as in the case of König (4). The accompanying diaphragmatic perforations demand separate consideration. In case an existing pneumothorax disappears by absorption, the lung may continue to act, and blood from an intra-abdominal organ may thus be aspirated into the pleural cavity. Thus no dullness may be found over the abdomen. The omentun may plug the opening (case 20), or a closure may be affected by the injured organ itself. This is probably the rule on the right side. The left side naturally gives rise to more complications. A loop of gut or a portion of the stomach may slip into the opening and become strangulated. This may occur quite late, as the following case shows.

M. F. 327477. Cook County Hospital. Dr. Schroeder. Admitted to the hospital, complaining of pain in abdomen. Bowels had not moved for three days. Transferred from medical to surgical side, with probability diagnosis of duodenal ulcer and pyloric obstruction. Abdomen somewhat distended. *Chest:* Dullness over lower part of left side; breath sounds somewhat roughened. Operation revealed adhesions about pylorus, also a scar. Lumen normal. On left side, transverse colon prolapsed into pleural cavity through a ring in the diaphragm. Resection of seventh, eighth, and ninth ribs. Reduction of prolapsed gut (18 inches), with about ten square inches of omentum. Suture of diaphragm. Recovery.

Subsequent inquiry revealed that patient had been shot in the side about a year previous, and recovered without operation. Small, almost imperceptible, scar found in left midaxillary line, seventh interspace.

Similar occurrences have been related by Repetto, Farinato, Bardenheuer, Spilman, Reid. In the majority of these cases, the prolapse occurred from eleven days to seven and one half years after injury.

Fritz König states (4) that wounds of the diaphragm may heal, not by union of the wound in the muscle, but by adhesions of the opposite serous surfaces about the perforation. This is said to apply especially to the dependent portions of the diaphragm. Schmidt's statistics upon this subject are instructive. Lacher's 36 and Popp's 33 cases treated conservatively ended fatally by hernia. Frey (5) had 4 recoveries under 33 cases treated in the same manner. Schmidt collected 44 cases treated by operation, with 42 recoveries.

Repetto's experiments show that wounds of the diaphragm manifest but little tendency to healing if not sutured. Plugging by and adhesions of omentum afford a poor safeguard against prolapse of the organs. In the case cited above, the omentum had probably occluded the opening at first.

PROGNOSIS AND COURSE

The character of the lesions in the cases depends upon:

1. Range, size, nature, and velocity of bullet.
2. Angle of incidence.
3. Histology of injured organ.
4. State of repletion of organ.

The sequelæ may be divided into early and late. In general, the following factors may influence the prognosis:

I. Early

(*a*) Hemorrhage from largest vessels or organs which cannot be extirpated. May prove fatal within a short time or be beyond control from beginning.

(*b*) Time of operation for:

1. Hæmostasis.
2. Prevention of infection. By gastrointestinal contents; urine; bile.
   Prevention of fat necrosis by pancreatic juice.
3. Arrest of irritative shock.

II. Late

(*a*) Infection.

1. Acute general peritonitis; sepsis. From primary infection; perforation overlooked; subsequent perforation of injured gut or stomach.
2. Subacute peritonitis.
3. Local abscess formation. Subphrenic abscess; urinary infiltration; suppurating hæmatoma; abscess of parenchymatous organs.
4. Hydropyothorax; pericarditis; lung-abscess; lung gangrene.

(*b*) Injuries to the spinal cord.

III. Later

Adhesions. Ileus.
Diaphragmatic hernia or prolapse.

The total mortality in the 27 cases of penetrating gunshot was 10 (38.1 per cent). There were 26 cases operated on, while one died without operation; a mortality of 34.6 per cent. Of these 26 cases, 3 should be eliminated as moribund when operated upon (cases 24, 21, and 23). There remains, then, a total of 23 cases, with a mortality of 25 per cent. Individual results were as follows: 15 cases (Dr. Schroeder), mortality 20 per cent; 8 cases (Dr. Riebel), mortality 37.3 per cent.

The cause of death in the ten cases was, approximately, as far as could be learned from post-mortem without microscopical examinations:

3. Sepsis ..... Third day.
6. Subphrenic abscess ..... Eighth week.
7. Shock; hemorrhage ..... Twelve hours.
14. Subacute peritonitis ..... Sixth week.
21. Acute general peritonitis ..... Second day.
22. Post-operative shock ..... 24 hours.
23. Hemorrhage ..... 12 hours.
25. Hemorrhage ..... 12 hours.
26. True shock; hemorrhage ..... 2 hours.

Bullets traversing the abdominal cavity anteroposteriorly give, as a rule, a better prognosis than those traversing from side to side or diagonally. Most of the cases were operated on from two to six hours after the accident, except two. One of the latter died. As to time of interference, the prognosis rapidly becomes worse with lapse of time.

Siegel's (6) statistics show the following mortality:

Laparotomy within first four hours 15.2%
Laparotomy after five to eight hours 44.4%
Laparotomy after nine to twelve hours .. 63.6%
Laparotomy later 70.0%
Mortality for the first twelve hours 28.0%

Case 3 died with indefinite symptoms of a general infection (rise of temperature, rapid pulse). No peritonitis evident. The post-operative shock in case 22 was undoubtedly due to complete evisceration. Infection of the wound with local peritonitis and establishment of fæcal fistula occurred in two (cases 8 and 14). The former recovered; the latter died of complications mentioned below. Of the late complications, subphrenic abscess occurred in case 6. Its origin is not clear. The site of the extirpated kidney had been drained. The abdominal wound closed without suppuration. The greater probability is that the abscess originated in the lung, extending to the subpleuric space, later through the bullet-hole in the diaphragm.

In case 2, a prolonged suppuration occurred from the abdominal wound, which did not close for six weeks. Patient developed a marked cough on the fifth day after the injury, and at the beginning of the third week the sputum became offensive in odor and contained pus. The possibility of an existing subprhrenic abscess emptying itself through the lung is great. Again, as the bullet fractured the eighth rib on the right side, a direct infection of the pleural cavity or lung has to be considered. Plain signs of accumulation of fluid, however, were not present.

One case (14) succumbed to a subacute peritonitis, probably with extensive adhesions. Despite evident injury to pleura and lung, no chest symptoms developed. He had fæcal vomiting, and died from ever-increasing inanition. This variety of complications appears to occur more frequently in the non-operated cases of war injuries. A slight infection of the pleural cavity was encountered in case 1, but, as free drainage existed, it ran a short course.

In two cases (4 and 18) of gunshot of the bladder, fistulæ developed. In case 4, the fistula closed spontaneously, while in the other case a secondary operation was required to effect a closure. No death occurred from overlooking a lesion. Average duration of convalescence was about five weeks.

TREATMENT

In the majority of cases, a median incision was employed, except where it was possible to ascertain position and height of both persons, and by this to judge the course of the bullet. In cases where the bullet pointed under the skin, the incision was made midway between this point and the point of entrance (transverse of diagonal course). An incision over the wound of entrance would have reached the seat of damage in but two instances.

In case 3 it became necessary to add a transverse incision to the median to reach the end of the furrow in the liver. No untoward effect resulted. Still further room may be obtained by resection of ribs (Lannelougue).

W. Meyer (7) of New York recently published a modification of methods previously suggested and partially applied by Micheli, Mikulicz, and Kelling. It consists of raising an osteoplastic flap after a median incision, to which is added a transverse to the tip of the eleventh costal cartilage. The attachment of the seventh costal cartilage to the sternum is severed. Then the hand passes outward between peritoneum and posterior sheath of rectus to junction of eighth, ninth, and tenth ribs, with their cartilages. These are divided. The space gained is considerable. I repeated this method on the cadaver, with a view of determining accessibility of convex surface of liver and cardia, and found this markedly increased.

Suture of diaphragmatic wounds is likewise greatly facilitated. The question of gaining access to the subdiaphragmatic space leads at once to the subject of transpleural laparotomy, which comes under consideration in combined injuries. This route was employed in three cases (Dr. Schroeder). The advantages offered by this method consist of:

(*a*) Access to retroligamentous portions of the liver, upper portion or whole of spleen, cardia, and cavity of lesser omentum.

(*b*) Possibility of successful suture of diaphragm. The marked advantages in wounds of the convexity of the liver became quite evident in case 1. Here, laparotomy with osteoplastic flap would hardly have exposed the whole wound. Again, extirpation of the spleen or suture is much more easily done by this route.

The second point — that of suture of the diaphragm — involves the question of both drainage and tamponade. Granting that either might be dispensed with under certain circumstances,

this cannot be done in all cases. Case 1 ran a course of moderate suppuration, in which, undoubtedly, the liver was involved. Case 20 recovered without suppuration.

If case 1 had been drained by the usual laparotomy, I doubt that the formation of a subpleuric abscess could have been prevented while transpleural drainage was direct and free. In two cases of transpleural laparotomy reported by Schäfer (4) from Madelung's clinic, the diaphragm was sutured and the pleural cavity alone drained. In both cases the spleen alone was injured (stab wound; gunshot). In both cases it was sutured.

If we assume that a shot-canal is always infected, and, furthermore, that the explosive action of a bullet may lead to changes in parenchymatous organs which later may give rise to suppuration, drainage would be a logical consequence. The disadvantage consists of the possibility of overlooking injuries below the subdiaphragmatic space. Hence its use in gunshots must always be a limited one, restricted to well-selected cases. In these, it shortens the duration of the operation and permits more thorough work. The production of a pneumothorax seems not to be followed by any evil results. An existing pulmonary hemorrhage may cease. Intrathoracic vessels may be secured. The treatment of the individual injuries may be summarized as follows:

Liver. Tamponade in eight cases (once by gauze and tube). Suture in one case.

Spleen. One extirpation. One suture.

Kidney. Two extirpations. One tampon.

Stomach. Suture.

Intestines. Suture was sufficient in the majority of cases. Out of eleven cases of intestinal injury, resection was required four times. 1. Small intestine, 8 inches, Murphy button; 2. Small intestine, end-to-end Connell suture; 3. Transverse colon, 6 inches, Frank button (Dr. Schroeder). 4. Small intestine, 4 inches, end-to-end (Dr. Riebel).

While some operators advise total evisceration, others counsel against it (Stimson). I believe that in my own case 22, the exitus was due to complete evisceration. The systematic search can as well be made by beginning at a marked point, returning the small intestine loop by loop into the abdominal cavity.

Urinary Bladder. The peritoneal cavity was opened in all cases of bladder injury. In case 4, perfect suture could not be accomplished. Drainage was carried to point of perforation after the method of Roux. Catheter in urethra. No attempt at suture in case 5. In case 10, the peritoneum was stripped back to the seat of perforation, as advised by Bardenheuer. Suture was then applied. Perineal drainage was added in this case. In case 19, the posterior perforation was drained through the gluteal region, the anterior one suprapubically. All cases recovered.

An attempt at suture of the diaphragm from below was made in all cases of combined lesions. The method of Rydygier was not used in any case. The case cited above makes it appear that nature does not close these perforations securely enough to dispense with suture. The technical difficulties in accomplishing suture are great at times, and it rests much with the individual case whether the patient should be subjected to the additional risk of suture through the pleural cavity. Again, it must be conceded that complications due to prolapse may arise years after apparent complete recovery.

Lavage with large quantities of normal saline and gauze drainage was employed in all cases.

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HISTORIES

CASE 1. G. H. 1821. People's Hospital. Bohemian. Admitted October 30, 1904;. discharged November 30, 1904. *Injury:* Right lung (lower lobe), diaphragm, liver (right lobe, upper surface). Bullet entered mid-axillary line level of seventh rib (fracture). Temperature 99°; pulse 110; respiration 20. No expectoration of blood. Dullness lower right chest. No dullness over abdomen. Rigidity of right rectus. *Operation* (Dr. Schroeder): Resection of three inches of seventh rib. Moderate amount of blood clotted and liquid in pleural cavity. Gutter in anterior edge of right lower lobe of lung continued through opening in diaphragm (diameter $\frac{3}{16}$ inch) into gutter on convexity of right lobe of liver, length 2–2½ inches. Bullet found at end of gutter; 38-caliber, lead; slightly flattened at tip. Moderate amount of hemorrhage. Tamponade of canal; drainage of pleural cavity. Slight suppuration; otherwise course uneventful.

CASE 2. C. J. Female, colored, aged 24 years. 2029. People's Hospital. Admitted March 18, 1905; discharged May 13, 1905. *Injury:* Liver, diaphragm, pleura (lung?). Shot by husband. Fell when shot, rose again, and walked down three flights of stairs. Pulse 90; temperature 99°; respiration 24. Wound with ragged and burnt edges on left side, mamillary line, level of ninth rib. Bullet palpable on right side, under skin, between seventh and eighth rib (both fractured) in anterior axillary line. No vomiting. Severe pain in abdomen. Diffuse rigidity of abdominal wall, more marked in upper half. Dullness in both flanks, indistinctly movable with position. No tympany. Chest negative. Patient ate hearty supper one half-hour before shooting. Injury of stomach and liver supposed. *Operation* (Dr. Riebel): Median incision. Abdomen filled with moderate amount of liquid and clotted blood. Edge of left lobe of liver showed broad, ragged groove about one inch deep running half-length of left edge. It continued on to edge of right lobe, depth 1½ inches. Transverse incision about 1½ inches long and parallel with costal arch added to expose right liver lobe. In right mamillary line a little to left of intact gall-bladder, course of bullet turned upward through liver substance. Canal in liver 1½ inches in length terminated opposite bullet. Considerable oozing. Hemorrhage stopped by Paquelin. Liver wound closed by interrupted catgut sutures. Drainage of canal. Tampon against edge of liver. Bullet removed through skin incision; 38-caliber; considerable flattening at one side of tip. Spleen, stomach, intestines, negative. Pulse at end of operation, 108; full, strong. Long course of suppuration. Some bile discharge from wound during first few days. Fourth week, persistent cough developed. Expectoration of offensive sputum containing staphylococci. Temperature 102–103°; pulse 120–140. Fifth week, area of dullness found on left side posteriorly, level of eighth, ninth, and tenth dorsal vertebræ. Puncture not permitted. Copious expectoration and severe cough continued. Temperature gradually declined; also pulse-rate. Recovery complete by end of eighth week. Wound closed; scar firm. *Examination* (three months later): Marked increase in weight; scar firm; no signs of hernia; no symptoms.

CASE 3. B. N. Irish. 2049. People's Hospital. Admitted April 8, 1905; died April 10, 1905. *Injury:* Descending colon. Shot in saloon altercation. Pulse 90; respiration 30. Considerable pain in abdomen. Tenderness of abdomen. Muscular defense marked on left side. No signs of fluid or air in abdomen. No vomiting. Smooth bullet wound on left side, one inch to right of anterior superior spine. Bullet beneath skin in back to left of third lumbar vertebra (transverse process fractured). *Operation* (Dr. Riebel): Incision midway between umbilicus and entrance wound. Defect size of dime on free margin of descending colon. Fæces about wound. Other organs negative. Considerable hemorrhage in retroperitoneal tissues. Defect closed by purse-string suture. Irrigation with salt solution. Gauze drain. Bullet extracted from back; caliber 42; not much deformed. Death after 48 hours. *Post-mortem:* No other injuries found; large retroperitoneal hemorrhage; heart and lungs negative; no peritonitis.

CASE 4. B. Jew. 2137. People's Hospital. Bartender. *Injury:* Bladder and small intestine. Received three shots. One caused a flesh wound of the arm; one perforated tibia of left leg, a little below tuberosity; the third perforated left iliac bone, a little below posterior superior spine. Patient seen 2½ hours after accident. Mind clear. Pulse 100, thready. Respiration shallow and labored. Skin cold, clammy. Mucous membranes pale. Considerable pain in hypogastric region. Muscular defense very marked. No fluid or air in abdomen. *Catheterization:* Small amount of bloody urine and some clots. *Operation* (Dr. Riebel): Median incision from symphysis upward about 3 inches. Two perforations in small intestine. No fæces in abdominal cavity. Closure by purse-string suture. Remainder of intestine negative. Small amount of bloody urine found in cul-de-sac. Bladder perforated at angle between bladder and rectum. Rectum intact. No wound of exit. Bullet felt in bladder. Bullet extracted through slit made in fundus. This was closed immediately by two rows of silk Lembert sutures. Caliber 32 jacketed bullet. Bullet-hole closed by Lembert sutures. Gauze drain in cul-de-sac. Layer suture of abdominal wall. Catheter in urethra. During first few days, some urine drained through abdominal wound. Drain removed on seventh day. Catheter removed on tenth day. Patient was recovering from attack of gonorrhœa. Considerable pus in urine for four weeks. Few pus-cells in urine on dismissal. Recovery complete in six weeks. Tibial wound closed in ten weeks under aseptic dressing. Six months later, patient returned with small fistula at upper end of incision. Slight diastasis of recti observed. No bladder symptoms. Fistula closed within four weeks.

CASE 5. H. L. American. 2148. People's Hospital. Admitted May 26, 1905; dismissed August 1, 1905. Revolver shot. Marked signs of shock. Pulse 120; hardly palpable. Pain in lower portion of abdomen. Slight muscular defense. No signs of fluid or gas in abdomen. Bullet wound with blackened irregular edges about a fingerbreadth to left of median line and two fingerbreadths above symphysis. Bullet palpable under skin, in region of right sacroscrotic foramen. *Catheterization:* Two ounces of bloody urine. *Operation* (Dr. Riebel): Incision through wound of entrance. Tissues much infiltrated with blood. Opening found at base of bladder, on right side, posteriorly; admitted little finger. Profuse hemorrhage on that side. No perforation elsewhere. Intestines and other organs negative. Suture of bladder could not be accomplished. Rubber tube inserted in opening in bladder. Hemorrhage stopped by tampon. Drain in cul-de-sac removed after 24 hours. Layer suture of incision. Catheter in urethra. Extraction of bullet. Drain. Patient in collapse. Intravenous saline. Extremities wrapped in cotton. Rallied well within twelve hours. Developed delirium tremens on third day. Tube removed on seventh day. Catheter removed on thirteenth day. Urine up to that time, bloody, containing small clots. Urine clear; small amount drained still through wound, remainder voided naturally; contained considerable pus. Amount voided 1,200–1,500 c.c. in 24 hours. Delirium ended at close of third week. Slight rises of temperature to 101°. Left hospital at end of eighth week. Wound closed; scar firm. Posterior wound closed. *Examination* (September 6, 1906): Firm scar; no hernia; no symptoms of any kind.

CASE 6. E. S. 2235. People's Hospital. Colored. Admitted July 11, 1905; discharged August 15, 1905. *Injury:* Diaphragm, lung, liver, kidney. Shot in right side, at intersection of midaxillary line and tenth rib, at a distance of eight feet, person standing directly to right of patient. No wound of exit. Severe pain over twelfth rib, 2½ inches to right of spine. Pulse 75. *Catheterization:* Bloody urine. Dullness in flanks. Pronounced muscular defense. *Operation* (Dr. Schroeder): Incision along right border of right rectus, extending downward from costal arch about 4½ inches and upward through one rib. Perforation of liver on inferior surface; upper pole of right kidney shattered; twelfth rib fractured at angle. Bullet in muscles of back. Extirpation of kidney. Tamponade of liver wound. Drain to kidney site. *Urine:* Voided 22 ounces first day, 32 ounces second day, 48 ounces third day. Course at first uneventful; later, irregular temperature. Wound clean; closed at end of third week. Persistent cough. Some dullness posteriorly over right side. Left hospital against advice; was not observed further. Death at end of ninth week. *Post-mortem* (coroner): Body much emaciated; firm and smooth scar at site of incision; peritoneum negative; spleen friable, not enlarged; at site of extirpated kidney, abscess found, walled off, communicating through opening in diaphragm, with an abscess in right lower lobe of lung; pus grayish and thin; some adhesions of lower right lung to parietal pleura; remainder of pleural cavity negative; liver wound healed; brain negative.

CASE 7. J. M. Colored. 2392. People's Hospital. Admitted October 11, 1905; died October 12, 1905. *Injury:* Lung, diaphragm, stomach, liver. Shot with revolver, close range. Temperature 96.8°; pulse rapid and hardly palpable. Facial expression very anxious. No vomiting. Great pain in chest and abdomen. Marked muscular defense. Slight tympany. No fluid. Wound of entrance, sixth left interspace, midway between mamillary and anterior axillary line. Edges of wound blackened. No ribs fractured. *Operation* (Dr. Riebel): Median incision. Blood-clots in abdomen. Some hemorrhage from under surface of liver. Two perforations in fundus; anterior and posterior wall a little above level of cardia. Anterior opening size of quarter-dollar; posterior a little larger. Cavity of lesser omentum contained some food particles and fluid. Opening found in diaphragm, anteriorly, corresponding with eighth interspace. Anterior perforation in stomach closed by three and posteriorly by two rows of Lembert sutures. Drainage to anterior and posterior perforation. Tampon under liver. Pulse ceased several times during operation; restored by direct heart massage. Attempt to close opening in diaphragm not successful. Patient rallied well during first four hours. Later, marked collapse, and death in twelve hours. *Post-mortem* (coroner): No signs of peritonitis; sutures intact; no hemorrhage; lung and pericardium intact; some hemorrhage in pleural cavity (left); bullet in center of right lobe of liver.

CASE 8. William P. Colored. 2631. People's Hospital. Admitted March 12, 1906; discharged March 25, 1906. *Injury:* Descending colon. Pulse 90; respiration 24. General condition good. Severe pain in abdomen. Left thigh flexed upon pelvis. Marked muscular defense on left side of abdomen. Wound of entrance one inch to right of left anterior superior spine. Edges irregular, blackened. No vomiting. No signs of air or fluid. *Operation* (Dr. Riebel): Incision midway between anterior superior spine and umbilicus. Tangent laceration of free side of descending colon found. Considerable extravasation of fæces. Small bridge of intestinal tissue between wound of exit and entrance. This was removed. Torn edges of wound freshened in form of a rhombus. Approximation in transverse axis of gut. No other injuries found. Bullet not found. Abdominal cavity flushed with saline solution. Drainage. Closure. Wound became infected. Removal of sutures. Development of fæcal fistula on seventh day. This was almost closed when patient was transferred to jail hospital six days later. General condition good. Made uninterrupted recovery.

CASE 9. J. H. Colored. People's Hospital. Admitted April 12, 1906; discharged April 28, 1906. *Injury:* Transverse colon, cæcum; abrasion anterior wall of stomach. Patient brought to hospital 15 hours after injury. Expression somewhat anxious. Abdomen rigid; some tympany. Had vomited several times. Considerable pain in abdomen and right thigh. Right thigh flexed. Was shot while stooping. Small wound of entrance median line between ensiform cartilage and umbilicus. Edges not blackened. *Operation* (Dr. Riebel): Incision through wound of entrance. Many

loops of small intestine infected; some covered with fibrine deposits. Fine adhesions between loops. Abrasion on anterior wall of stomach, near greater curvature, inverted by three Lembert sutures. Double perforation of transverse colon; single large opening in free border of cæcum found, and closed by purse-string suture. Considerable extravasation fæces from all perforations. Opening found in fascia over obturator foramen. Bullet probably lodged in thigh; not found. Abdomen flushed with normal saline. Counter-incision in both lumbar regions. Gauze drains in median and lumbar incisions. Partial closure of median incision. Tincture opium (15 minims) given four times daily during four days. Then enema of equal parts of milk and molasses, one pint, on fifth day. Course stormy during first four days. Temperature normal on fifth day; patient rallied. Wounds closed at end of third week.

CASE 10. E. L. 7406. Provident Hospital. Colored. Admitted January 1, 1905; discharged February 6, 1905. *Injury:* Bladder, small intestine, rectum. Shot in back, from above. Wound over left sacro-iliac joint. Small swelling in upper and inner half of right thigh, 1–2 inches below groin. (Bullet.) *Catheterization:* Blood in urine. *Operation* (Dr. Schroeder): Median incision below navel; some blood in peritoneal cavity. Number of perforations in small intestine. Eight inches resected. Perforation in posterior wall of bladder. Bladder opened and other perforation found at neck. Both closed. To suture posterior perforation, bladder peritoneum was stripped back. Abdominal and perineal drainage. Perineal tube removed after three weeks. Catheter introduced. Murphy button used in resection; passed after 24 days. Uneventful recovery.

CASE 11. C. K. 2674. People's Hospital. German-American. Admitted April 19, 1906; discharged June 20, 1906. *Injury:* Two bullets; lung, diaphragm, stomach. Considerable shock on admission. Vomited blood. Pain in abdomen. Marked muscular defense. Upper entrance wound about level of sixth rib, two inches to left of spine. Lower entrance wound over tenth rib. *Operation* (Dr. Schroeder): Incision through left rectus from costal arch downward. Considerable hemorrhage in abdominal cavity. Two perforations in fundus about opposite cardia, about size of bullet; closed by suture (32-caliber). Small amount of gastric contents in abdominal cavity. No other organs injured. Bullet found in peritoneal cavity. Irrigation with salt solution. Drainage. Entrance wound of upper bullet dressed with gauze. Uneventful recovery.

CASE 12. E. A. Colored. 2033. Provident Hospital. Admitted February 7, 19??; discharged March 14, 19??. Shot with revolver, 32-caliber. *Injury:* Liver, right kidney; entrance wound not stated. *Operation* (Dr. Schroeder): Liver perforated 4–5 inches above lower border. Right kidney perforated. Abdomen contained large amount of blood. Tube wound with iodoform-gauze introduced into liver wound. Tampon below liver. Irrigation. Course uneventful.

CASE 13. P. B. German. 2776. Provident Hospital. Admitted May 26, 1901; discharged June 29, 1901. *Injury:* Small intestine. Shot during target practice with 22-caliber rifle. Entrance wound at Poupart's ligament, on right side. *Operation* (Dr. Schroeder): Three perforations found. Resection and end-to-end anastomosis with Connell suture. Course uneventful.

CASE 14. T. S. Colored. 2926. Provident Hospital. Admitted August 31, 1901; died October 27, 1901. *Injury:* Lung, diaphragm, liver, transverse colon, small intestine; bullet wound in the back, two inches to right of spinal column; seventh, eighth, and ninth ribs fractured; anteriorly, bullet felt in mamillary line region of eleventh or twelfth rib. *Operation* (Dr. Schroeder): Two perforations of transverse colon, one of small intestine, were closed. Canal in liver (packed). Bullet removed from chest-wall. Drainage in abdomen after irrigation. Drainage of entrance wound. *Course:* Suppuration of abdominal wound. Fæcal fistula developed after four weeks. A week later, fæcal vomiting. Progressive emaciation. Temperature subnormal, later part of course. Exitus on fifty-seventh day. No post-mortem.

CASE 15. H. H. Colored. 3098. Provident Hospital. Admitted November 30, 1901; discharged December 23, 1901. *Injury:* Stomach, liver. Shot with revolver at 6:55 A.M., close range, so that there was burn of the first degree about wound, and clothes had taken fire. Did not fall after shot. General condition good. Pulse 85; temperature 100°; respiration 24. Vomited blood at 9 A.M. Entrance wound over center of sternum, on level with sixth costal cartilage. *Operation* (Dr. Schroeder): Median incision. Direction of shot, diagonal, through left lobe of liver and stomach, also lesser curvature (two perforations, anterior and posterior wall). Closed by suture. Small amount of gastric contents in abdominal cavity; removed by sponging. Tampon. Gauze-drain closure of incision. Recovery uneventful.

CASE 16. T. T. Colored. 3119. Provident Hospital. Admitted December 10, 1901; discharged January 4, 1902. *Injury:* Stomach. Intense pain in abdomen. Muscular defense. Shot with revolver, 22-caliber. Entrance wound two inches to left of median line and two inches above umbilical line. *Operation* (Dr. Schroeder): Wound in anterior wall of stomach. Suture. No stomach contents in peritoneal cavity; no hemorrhage. Other organs intact. Drainage. *Course:* Some cough, and rise in temperature to 12, 15, 01; then uneventful.

CASE 17. D. M. Irish-American. 3903. Provident Hospital. Admitted October 22, 1902; discharged November 5, 1902. *Injury:* Transverse colon. Wound two inches below costal margin, on left side. *Operation* (Dr. Schroeder): Six perforations of transverse colon. Hemorrhage in omentum. Bullet free in peritoneal cavity. Resection of six inches of transverse colon; end-to-end anastomosis by means of Frank button. Reinforcement of anastomosis by invagination. Course uneventful.

CASE 18. A. J. Colored. 4343. Provident Hospital. Admitted March 24, 1903; discharged May 1, 1903. *Injury:* Bladder. Patient walked into hospital. Bullet wound on left side, one inch above Poupart's ligament,

midway between anterior superior spine and pubic spine. *Catheterization:* Blood in urine. *Operation* (Dr. Schroeder): Perforation of bladder; anterior and posterior suture of posterior perforation. Drainage of anterior perforation by tube. Vesical fistula. May 9, 1903, closure of fistula by operation.

CASE 19. O. S. Colored. 4360. Provident Hospital. Admitted March 29, 1903; discharged May 1, 1903. *Injury:* Bladder, small intestine, fracture of ischium; entrance wound median line, two inches above pubes. *Operation* (Dr. Schroeder): Perforation of anterior and posterior wall of bladder. Two perforations of small intestine (suture). Bullet under skin in gluteal region. Posterior perforation of bladder drained through gluteal region. Anterior bladder-wall sutured to abdominal wall. Fragments of bone removed. *Course:* Slight cystitis; uneventful.

CASE 20. G. R. Colored. 5365. Provident Hospital. *Injury:* Diaphragm, spleen, kidney. Revolver shot. Entrance wound in left ninth interspace midaxillary line. Bullet palpable in back, under skin, between first and second lumbar. General condition good. Dullness on left side over abdomen and in lumbar region; not movable with position; no characteristic boundary. Some dullness over chest, posteriorly, on left side. *Operation* (Dr. Schroeder): Incision over entrance wound. Resection of eighth and ninth rib; removal of 2½ inches. Moderate amount of hemorrhage in pleural cavity; gutter in left lower lobe of lung. Perforation of diaphragm. Enlargement of perforation; spleen drawn upward, upper one third shattered, profuse hemorrhage. Extirpation. Kidney examined; upper half shattered; extirpation. Suture of diaphragm. Drainage of pleural cavity. Course uneventful.

CASE 21. F. R. Italian. 1295. People's Hospital. Admitted November 17, 1903; died November 19, 1903. *Injury:* Pleura, lung, diaphragm, liver, kidney, diaphragm. Brought to hospital ten hours after injury. Entrance wound seventh right interspace, a little to left of anterior axillary line. Bullet under skin, in back, between tenth and eleventh rib. *Catheterization:* No blood in urine. Abdomen tympanitic. Pneumothorax. *Operation* (Dr. Schroeder): Resection of two inches of eighth rib. Considerable hemorrhage from lung. Perforation of diaphragm enlarged by incision. Gutter found in convexity of liver; perforation in upper pole of kidney. Pneumopexy (to diaphragm); drainage to liver and kidney wound. Closure. *Course:* Died after 36 hours, of peritonitis.

CASE 22. N. N. Italian. People's Hospital. Died. *Injury:* Transverse colon, descending colon, transverse mesocolon. General condition good. Pulse 90; respiration 30. Revolver shot. Entrance wound left mamillary line, margin of costal arch. Palpable under skin, a little above anterior superior spine (right). Marked muscular defense. No fluid or air. Vomiting. *Operation* (Dr. Riebel): Median incision. Transverse mesocolon torn to considerable extent. Hemorrhage; infiltration. Attached portion of transverse colon showed long rent quarter of bowel circumference. Two perforations in ascending colon (attached portion). Hæmatoma in mesocolon. Suture of perforations. Considerable fæces about perforations. Evisceration of small intestine. Irrigation. Drainage. Exitus after twelve hours. *Post-mortem* (coroner): No peritonitis; sutures intact.

CASE 23. R. H. Colored. 2503. People's Hospital. Admitted December 25, 1905; died December 28, 1905. *Injuries:* Two bullets: (*a*) Small intestine; (*b*) Both lungs (lower lobes). In extreme collapse when admitted. Intravenous given. Marked muscular defense. No fluid or air. Vomiting. Received two revolver shots: (*a*) Entrance wound on left over middle of Poupart's ligament; (*b*) Left midaxillary line, fifth interspace. *Operation* (Dr. Riebel): Median incision. Loop of small intestine two feet in length showed eight perforations. Extravasation of fæces about some of them. Resections of four inches containing four perforations. End-to-end anastomosis by suture. Remaining four perforations distributed over 1½ feet of gut closed by suture. Slight defect on under surface of liver. No hemorrhage. Irrigation; drainage. Died after 48 hours. *Post-mortem* (coroner): Sutures intact; no peritonitis; bullet 38-caliber found in cul-de-sac; upper portion of right lower lobe shattered; bullet found in lung substance (right); greater portion of left lower lobe shattered; pleural cavity almost completely filled with blood; heart, pericardium intact.

CASE 24. N. N. American. People's Hospital. Died two hours after operation. *Injury:* Liver, portal vein, descending colon. Entrance wound on left side, midway between anterior superior spine and umbilicus. Extreme collapse. Extensive movable dullness over both sides of abdomen, laterally and in hypogastric region. *Operation* (Dr. Schroeder): Abdomen filled with blood. Right lobe of liver torn almost in two from below upward. Packing; closure. *Post-mortem:* Large opening in portal vein.

CASE 25. N. N. Colored. People's Hospital. Admitted ——; died after 12 hours. In collapse when admitted. *Injury:* Branches of cardiac axis? gastrocolic, omentum. Entrance wound about tip of eleventh rib. *Operation* (Dr. Schroeder): Extensive hemorrhage in free abdominal cavity and cavity of lesser omentum. No injury to organs could be found. Packing. No post-mortem.

CASE 26. N. N. Irish-American. People's Hospital. Died two hours after injury. *Injury:* Lung, diaphragm, liver, diaphragm, lung (right). Shot with a 44-caliber revolver, at close range. Immediate loss of consciousness. This returned in about 45 minutes after stimulation. Pulse not palpable. Died about two hours after accident. No interference. *Post-mortem* (coroner): Abdominal cavity well filled with blood. Tear nearly through whole thickness of liver at convexity (entire length transversely); from this emanated many smaller tears in all directions. Portions torn away from both lower lobes of lung. Bullet entered in seventh interspace (left) midaxillary line. Seventh and eighth ribs fractured in several places. Pointed under skin a little anterior to midaxillary line at eighth rib (fractured) on right side. Bullet much flattened.

CASE 27. C. H. American. Aged 13. Provident Hospital. Admitted October 30, 1905; discharged November 21, 1905. *Injury:* Spleen. Shot by boy in play, with 32-caliber revolver. Shot at ten feet distance, bullet glancing from a post. Patient taller than boy who shot. No signs of shock on admission. Entrance 1½ inches from spine (left), level of ninth rib, posterior scapular line. Opening probed; direction found downward. Laparotomy incision outer border of left rectus. Spleen furrowed on top; hemorrhage. Slight bruise over greater curvature of stomach. No injury of intestines. Furrow in spleen closed by a few interrupted sutures. Bullet found in mesenteric fold. Drainage. Recovery uneventful.

CASE 28. W. Colored. People's Hospital. *Injury:* Non-penetrating gunshot. General condition good. Pulse 84; respiration 24. Small bullet wound over center of line between umbilicus and right superior iliac spine. No muscular defense. *Exploratory laparotomy* (Dr. Riebel): Incision a little internal to wound. Organs intact. Closure. Discharged in ten days.

SURGERY OF THE ABDOMEN[1]

BY E. WYLLYS ANDREWS, M. D., CHICAGO

BEFORE discussing the surgery of the abdomen, I wish to report an interesting case that I had to-day, and to show you two skiagrams of a Civil War bullet. The first skiagram I exhibit shows a large-sized, spherical Civil War bullet imbedded in the outer external condyle of the right femur, plainly visible, and in the tract near it a number of fragments of lead, easily differentiated. This bullet had remained from the year 1863 until this morning, when we removed it by operation. The reason for interfering in a case of so long standing was the recent occurrence of ostitis, a small amount of necrosis, and a persistent sinus, leading, not to the site of this bullet which I show you, and which, you see, corresponds to the picture there, but to the small fragments, and, strictly speaking, operation for the removal of this large spherical bullet proved unnecessary, as it was perfectly encysted. A diagram corresponding to this skiagram illustrates the trephine opening in the end of the femur and the location of the bullet.

As to abdominal surgery in military practice, I can only say that one of the most striking things to me, in our art-science, is the extraordinary contrast between the results and conclusions as to penetrating wounds of the abdomen in military surgery and those in civil or in private practice. We can hardly assume that this difference lies in the time of collection of these statistics. The preantiseptic period of the Civil War is arrayed against our modern civil practice, which we have only known for the past generation. To most of us, antiseptic surgery is the only kind of surgery we have ever known. But we must remember that the very unfavorable conclusions as to end-results of abdominal inferference in penetrating wounds have been confirmed, under the strictest application of the antiseptic principle, in the late Boer War, by so eminent a practitioner, and so careful and able a surgeon and writer, as Sir Frederick Treves, who, if I am properly informed, has been quoted to the effect that in the South African war, on the whole, they got as many recoveries from non-interference as from operative treatment of gunshot, shell, and stab wounds of the abdomen or of the hollow viscera. There is, I hope, not one of us here in America who, in civil practice, is not firmly convinced that he can save more lives by performing laparotomies than by any kind of conservative treatment. I should not have spoken of this had I not recollected that one of our best surgeons was led astray, in his admiration of Sir Frederick Treves's writings, and he believed, too, for a while that he would get, on an average, better results if he let some of his penetrating wounds of the abdomen alone, treating them simply by non-operative methods. He has had reason to regret this conclusion, he later informed us.

How can we explain this striking contrast, and what is the moral to us? We can cite some of the conclusions referred to by one or two of the other speakers, Dr. Adams particularly, about the hydrodynamic and other destructive influences which the modern high-

[1] Read before the Chicago Surgical Society, December 7, 1906.

power bullets have in the abdomen, as in any other part of the body, consisting of cavities filled with fluid. Complications explain the differences. We know that a fracture of the spine may be perfectly harmless, provided the medulla is not injured. A fracture of the skull may be devoid of danger; a fracture of the pelvis may be devoid of danger, and in some cases followed by an easy recovery when viscera are involved. It is exactly the same way in considering injuries of the abdomen and of the abdominal hollow viscera. A wound of the intestine with a moderate-sized penetrating body, knife, or pistol-ball, or something smaller than a fragment of shell, may be easily handled in a straightforward, simple manner, or it may be very complicated. Military wounds belong to a class associated largely with complications. In proportion as wounds of the abdomen and of the abdominal viscera are associated with profound shock, and with an extreme degree of hemorrhage, a great degree of laceration, and do not consist simply of small perforations, they become, so to say, beyond our reach; we stand helpless before them, and when we interfere, our success is meager.

The modern bullets are much smaller and lighter than the old-fashioned, heavy lead ones, but their "explosive effect," as alluded to by Dr. Adams, is less at certain ranges. The explosive effect belongs, not to hydrostatic, or hydrodynamic, but to hydraulic, phenomena. For example, the stomach or colon full of fluid, or half-filled, carries that explosive wave he speaks of. If one of these high-power rifle-bullets, which will go through eight men in line, be fired into an iron-hooped barrel full of water, I am told by military surgeons that it will rupture the hoops. I knew of an autopsy in Major Girard's service at Fort Sheridan, on a prisoner, a soldier who was shot in the back of the head by one of the guards while trying to escape. There was a small perforating wound in the occiput, but the hydrostatic wave had shattered the vertex extensively and had nearly "blown the top of his head off." Inside of the smooth scalp there were a dozen fragments. In a case of full stomach or colon, we may have destructive wave effects, and that may account for some of the differences; yet I do not think it can account for all of them. We have yet to be convinced, and I myself shall be slow to believe for a long time, that, given the same conditions, given men of the same degree of skill as those who are doing most all of the surgery in the large centers, a larger proportion of cases of penetrating wounds of the abdomen cannot be saved by operating than by resorting to conservative treatment. We have to remember not only that conditions are less favorable in field-hospitals, and that the wounds are larger and more ragged, but also that the average of technical skill in the operative force must also be somewhat less. The average skill, perhaps, we might say, would be less centered on one single specialty; that is, we should not have many surgeons who had made a special study and practice of abdominal surgery in field-hospitals in the best armies of the world. Of course, these would be men who had had broad training in hospital management, who would be excellent skilled physicians and good internists, who would know about the management of surgery in army organization, and many other things, but comparatively few of whom would become picked operators, except in certain permanently located army stations. For that reason, and for other reasons, so far as applies to our own personal experience here, army statistics will never modify my conclusions in a very great degree. We must, of course, consider the wounds we see in civil life as belonging in the same category as those at non-explosive range with the small high-power missiles. All our wounds, when made with firearms, are those of revolver-bullets, which have no explosive effect. The missile may enter the abdominal cavity and pass through one, two, or many loops of intestines. I have operated on one case in which one bullet made thirteen holes.

I would say, then, that not only should we not allow the conclusions, however well founded in military practice, to modify very seriously our practice in civil life, but we should go on and urge as strenuously as possible that it is our duty in civil practice not only to open every case of abdominal perforation that we may diagnose, but also to open every case of gunshot wound in or about the belly cavity which we cannot diagnose, but only suspect to have wounded a viscus. A negative finding does no harm. It has happened in my own practice

that a bullet has traveled straight through the abdomen, among the intestines, and has not made a hole in any one of them. In one or two cases I have found the bullet in the lumen of the bowel or stomach. Occasionally I have operated upon one of these cases where I found no cause for operating. The patient might have been just as well if I had not operated; yet, on the whole, I have not had the slightest regret for having settled the doubt by operating. Can you imagine a more deadly error than to leave unoperated one such case which needs it?

PRIMARY FIELD DRESSINGS[1]

By P. J. H. FARRELL, M. D., Chicago

THE conduct of the surgeon in the field must be regulated: 1. By the number and importance of the wounded to be aided: and 2. By the material at his disposal for doing his work.

First aid to the wounded is one of the most important problems in modern military surgery. To comprehend the extent of its application it is necessary to fix with exactness the character of the wounds. Every combatant should be provided with a "first-aid" package and taught how to render to himself and to his comrades the care that may prevent death or permanent disability. The work of the surgeon on the firing-line must be limited to stopping hemorrhage, covering wounded surfaces with adequate simple dressings, applying splints, and reviving with hypodermics those suffering from severe shock.

When speaking of primary field dressings, it must be borne in mind that surgeons personally attend but few of the wounded in a serious engagement. The aid that a man applies to himself at the moment of being wounded implies the necessity of giving every combatant the necessary elements of a first dressing and instruction how to apply it. Not many years ago this was the exclusive work of the surgeon, but the first dressing can be applied by the ordinary solider, and much suffering and danger from infection is thereby avoided.

Volkman spoke with reason when he said that the fate of the wounded rested in the hands of the one that applied the first dressing; that military surgeons should give up probing wounds with the promptness that they used to exercise to find and extract the projectiles that without the least inconvenience can remain where they are, or at least until they can be extracted in the field-hospital; and that the immediate application of a simple dressing has been as beneficial to the soldier as the reduction of the caliber of the rifle. It is true that the rifle is not the only arm that the soldier uses. Artillery fire causes, also, a considerable number of wounds, that differ materially from those caused by the small bullet of the modern rifle; but, as the proportion of the wounds of the latter to those of the former is by far the greater, to the rifle-bullet is ascribed the character to the wounds received on the field. Thus to the character of the wounds received from rifle-bullets has been directed all that has been said and done of late years in the way of procuring a first dressing that shall be efficacious on the battle-field. The rifle undoubtedly is the principal fighting-arm of the modern man of war, although the bayonet and saber are again coming into favor. A fact which goes to show that the bayonet is by no means an obsolete weapon is, that it was responsible for seven per cent of all wounds in the Japanese army in Manchuria.

The small projectiles hardly ever introduce into the tissues fragments of the cloth or portions of the soldier's uniform or foreign bodies to infect the wounds. Practically, we may consider these as aseptic; and it is sufficient for the person applying the first dressing not to infect them, in order that the healing may be quick, and leave remaining no trace of the missile through the tissues. In the majority

[1] Read before the Chicago Surgical Society, December 7, 1906.

of cases, the injury produced by the modern rifle-bullet is insignificant. The bullet passes through the tissues almost without injury to them. At times the wounds of entrance and exit are difficult to distinguish. Frequently the superficial wound is smaller than the bullet itself. If the bullet has been split, either accidentally or intentionally, or strikes a bone, serious destruction of the parts will frequently be found. Artillery fire, shell and shrapnel, produces more serious wounds, which requires greater skill in the field. Attending those wounded by field-artillery or cavalry is a more difficult task than that in the case of those wounded by slow-moving infantry. The disposal of the wounded of mounted troops is a very much more difficult matter; for the object in mounting men is to render them mobile, and every wounded man tends to hamper their mobility. It is therefore necessary to dispose of their wounded quickly and thus restore mobility. Most cavalry officers consider that on many occasions their wounded would have to be abandoned. This does not seem a very grim prospect in a war with a civilized nation, for the chances are that they would be found and be treated kindly, even by the enemy; but the whole aspect changes when fighting a foe that does not respect the usages of civilized warfare. Then the wounded cannot be left on the field, possibly to a death preceded by torture and mutilation.

Special aid should be provided for first aid in the case of wounded cavalrymen of field-artillerymen. There should be no division of responsibility in looking after the wounded, for if any are detailed for this purpose, others of the troop may think it incumbent to remain too; whereas if special aid is provided, the attempt to fall out and remain with the wounded could be summarily prevented and fairly forbidden, once the men possess the knowledge that the best provision possible was made for the wounded and that no responsibility rested with the individual soldier. The cavalry leader's hands would thus be free, the number of mounted men on the firing-line would be at the maximum, and the many casualties that occur when withdrawing the wounded would be much reduced. The quicker the wounded receive first aid, the more men there will be on the firing-line. Under the conditions of modern rifle fire and antiseptic surgery, the wounded, if promptly protected by a primary dressing, may quickly recover, to fight again in the same campaign. The surgeon on duty with cavalry should be as good a horseman as the cavalryman. The medical officers doing duty under fire, assisted by the hospital corps, render first aid as promptly as possible; they place the wounded under the nearest cover, shifting them as little as possible; they make them comfortable, ease pain by hypodermic injections of morphia, and administer stimulants where necessary; then, on the first opportunity, during a lull in the firing or a change in the position of battle, the litter-bearers begin moving the wounded from the firing-line to the dressing-stations or field-hospital, which should not be in the line of fire, but under the best cover possible, on either flank, so that bullets and shells passing over the troops engaged will not further endanger the wounded or the hospital corps.

In warfare in a civilized country, there are usually the means in every town or village to make the wounded more comfortable. Houses, furniture, and even food, are available, unless the enemy, before retiring, has destroyed the property of the citizens. A medical officer is in a position to demand that his wounded have everything that may be needed, and it is his duty to point out what they require, and what houses would be most suitable for their accommodation. As a rule, only the larger buildings are of value, on account of the cubic space required and the necessity of collecting the sick and wounded together, so as to facilitate medical attendance and nursing. All food suitable for sick and wounded should be obtained, and also any furniture that may be required, especially beds. No wounded or sick should be treated on the ground when beds are available. Stores containing wares necessary in the care of the wounded should be the subject of a speedy requisition, and medical officers should see to it that diligent search is made for such, in the interest of their patients. The feelings and susceptibilities of the inhabitants of the invaded country demand respect, but the welfare of the sick and wounded comes first. With tact and discretion, the balance can

be duly adjusted. One of the lightest penalties falling on a conquered country is to supply necessaries and shelter for the sick and wounded on payment.

Medical officers must therefore be fit to perform their duties on active service, and undergo the hardships incidental to campaigning. An ordinary simple bullet-wound can be dressed by those nearest, both the wounded man and he who succors him being often able to remain protected by cover; but there are a number of wounds that call for immediate attention by the surgeons, and for attendance on such cases, under a hot fire, the surgeon's dexterity is indeed stimulated by the "ping" of the bullet. In every war one hears of medical officers and hospital corps men being fired upon when attending the wounded. Of course, with very few exceptions, this is absolutely unintentional, and generally results from distance preventing the possibility of distinguishing one man from another.

There is no good reason for removing the wounded while under fire. The risk is too great, unless the force is retiring rapidly before a savage foe. All that the wounded require is field dressing and good cover, so that they shall not be hit again, and a hypodermic of morphia injected if in pain. I have frequently seen surgeons and hospital corps men wounded while moving men to the rear. There is no surgical training that equals active field service in developing dexterity and rapidity. I think that all military surgeons agree with Colonel Senn, who states in his able article on "First Aid on the Battle-field," "The first-aid dressing should combine simplicity with safety against post-injury infection. The first dressing in general use that should be on the person of every combatant must necessarily be of the simplest kind, in order to become efficient and useful in the hands of the soldier. It must be compact and easy of application. No soldier will encumber himself for any length of time with a bulky dressing." The Senn antiseptics incorporated in the dressing, boric and salicylic acids (4 to 1), give the best results; iodoform is too stimulating; dressing should be changed frequently; in hot weather, once or twice daily; if the patient perspires freely, there will be less infection if the dressings are changed twice a day; bandages and adhesive rubber should be avoided if possible, and collodion used to secure the ends of the dressings; in this manner heat and pressure, that increase the exudate from the wound, and escape of bacteria from the skin, are to a great degree prevented. In fracture of long bones of the extremity, the opposite limb can be made use of as a splint. The rifle, bayonet, and saber are always available, and can be used as temporary fixation splints. A fractured humerus can be immobilized by fastening the arm to the chest. A well-padded bayonet can be used in fractures of the forearm. Care must always be taken in the field, when applying the primary dressing in fracture cases, not to place a pad over a projecting bone that lies close to the skin and threatens perforation, but over the bone, a short distance away.

The great protection afforded the patient by frequently changing sweat-moistened dressings — an ideal culture-ground for the skin bacteria — is well understood by military surgeons, and, in my experience, was first generally recognized eight and a half years ago by our surgeons in the Philippines. The daily or bi-daily changing of dressings practically stopped one of my most annoying surgical complications; viz., stitch abscesses.

Döderlein of Tubingen reported, in the primary floor of the abdominal cavity, an incision in one hundred cœliotomies, and in similar previous work. His tests showed that in spite of the most vigorous protection afforded by modern aseptic technique, consisting of rubber gloves and rubber covering for the abdomen, etc., the abdominal cavity, as well as the incision, invariably contained bacteria. This agrees with his previous investigations, as well as with those of others in which a germ-free field was unattainable. *Döderlein is also in accord with other authors in considering the skin of the operative field the last and most important source of the injection.* To exclude this source, the disinfection of the skin does not suffice. That is as unattainable as the complete disinfection of the hands. Especially difficult to reach are the germs in the deeper layers of the skin. He suggests a course to be pursued, in which the aim is to hinder the delivery of germs from the skin of the wound. After the patient is prepared by bathing, lathering, and shaving,

the skin of the entire neighborhood is forcibly rubbed with formalin-benzine or iodine-benzine, and then painted with pure tincture of iodine. The object is to render the skin, during the operation, as sear as possible. Over this iodine-paint is placed with the utmost care a sterile solution of rubber, so that it adheres tightly. After the rubber membrane is dry, it is sprinkled with sterile talcum to cover its stickiness, and it is now a thin, smooth, shining, sterile membrane, cleaving to the skin, which can be, after the operation, easily removed by benzine. Many cultures controlled the results with and without this rubber protective, and showed that with it Lister's ideal of a germ-free operation could be attained.

Von Bruns (Tübingen) said that in sixty successive cases, where the usual skin disinfection was done, all contained staphylococcus albus. The imprisonment of these skin bacteria is urgently needed and is accomplished in an ideal manner by this rubber covering. It sticks remarkably, and is durable in spite of its thinness. With it, it is possible to keep an aseptic field in a region rich in bacteria. In this clinic the stock solution of rubber coming from the factory is diluted with iodine, two per cent, in benzine, and before applying the rubber a disinfection is done by applying a one-per-cent solution of iodine-benzine.

Heusner (Barman) rejects entirely the washing of the skin, and, instead, paints it with a one-per-cent iodine-benzine solution, to which is added a little paraffin oil (liquid vaseline), by which means the germs are fixed.

Von Oettingen advises, especially in war, surrounding the wound with a solution of mastic, 20 grams, chloroform 50 grams, and linseed-oil 20 drops, and affixing to this sterile cotton.

Japan has given to the world a striking proof of the inestimable value to an army in the field of a large and well-organized medical department. She has also taught the still more important lesson that the efforts of the military surgeon to be effective must be supported by the officers and by the men of the line. We have in our own army to-day three well-trained medical men with the rank of general. I believe that their knowledge will give the country a more effective army. They would have more men on the firing-line and fewer in the hospitals than men less trained and educated. The words of Napoleon are as true to-day as when first uttered, "Victory and God Almighty are always on the side of the heaviest battalions."

The first object of the military surgeon is to keep the soldiers in good fighting condition, and the second, to relieve the wounded and attend the sick.

GUNSHOT WOUNDS OF THE NECK[1]

By T. J. SULLIVAN, M. D., Chicago

GUNSHOT wounds of the neck, involving all the walls of the large vessels, are rapidly fatal on the battle-field. Similar wounds of the spinal cord are also fatal in a very short time, or later from the septic complications that usually follow a high destruction of the cord.

During the Civil War, gunshot wounds of the neck, including wounds of the trachea, larynx, pharynx, œsophagus, and the various complications of these structures, numbered 4,895. The mortality was about fifteen per cent, and there were some very remarkable recoveries.

During the Spanish-American War, in cases reported, where the blood-vessels or spine were not involved, the wounds usually healed very rapidly and gave no mortality. The wounds of the neck inflicted by the bursting of shells accompanied with the tearing open of the main blood-vessels, with or without serious injury to the spine, will terminate fatally on the battle-field. The same can be said of saber and bayonet wounds.

[1] Read before the Chicago Surgical Society, December 7, 1906.

No doubt, when the reports on the Russo-Japanese and Boer wars are fully tabulated and available, the mortality will be extremely low in all cases where the spinal cord is not divided, and also in those cases where the main blood-vessels have not been severed, as just stated of the cases reported in the Spanish-American War. Where the neck is wounded by shells or shrapnel, or where there are bayonet and other wounds of equal severity, it is easy to see that the cases will terminate fatally on the battle-field before surgical aid can be rendered. It is also a fact that wounds of the neck are usually complicated with wounds of the face and thorax; so this subject must be considered in connection with injuries to the organs referred to above, and is modified very materially by these injuries.

In a recent Russian report on wounds at close range, involving the large vessels or trachea, the author states that they were alway fatal. Perforating wounds of the neck inflicted at a distance of four hundred paces or more, not involving the large vessels, are not mortal. The above statements are modified very materially when wounds are inflicted at a range within two hundred paces, for the explosive effect of the small-caliber bullet is very great, and more apt to be fatal, on account of the laceration and tearing of tissues in a very severe manner. The same bullet, in passing through the neck at a long range, is more apt to leave a clean-cut small opening, and is not fatal, the wound healing rapidly.

Fracture of the spine with compression of the cord necessitates operative interference.

Wounding of larynx or trachea, if followed by dyspnœa, may terminate fatally, unless relieved by tracheotomy.

GUNSHOT WOUNDS OF THE THORAX

Gunshot wounds of the thorax, according to Dennis, form about fifty per cent of those which terminate fatally on the battle-field. During the Civil War the mortality in gunshot wounds of the thorax was 62 per cent. It is doubtful if, in modern warfare, in cases where the large vessels are involved, and the bullet was fired at close range, and traversed the entire chest-wall, that mortality can be lowered much. Yet, it is gratifying to note, in a report of Surgeon-General Sternberg on the wars of 1898 and 1899, that, taking all the wounds of the thorax, this frightful mortality was lowered to 27.8 per cent.

Gunshot wounds of the thorax may be divided into two classes, penetrating and non-penetrating. In the non-penetrating wounds the mortality may be as low as one per cent. The penetrating wounds may be complicated by fractures of the ribs, sternum, vertebræ, clavicle, or scapula, and by wounds of the axillary and scapular vessels, a great number of the latter proving fatal.

According to Senn, a patient has a much better chance of life if the bullet pass through the chest-wall than if it become lodged. He is also of the opinion that injuries to the chest, inflicted by Mauser bullets, are not usually fatal, even if the lung is perforated, unless there is severe hemorrhage. Francis Abbott, in the London *Lancet*, says that such cases tend to get well. In the wounds of the thorax produced by a small-caliber bullet, unless the hemorrhage is severe, it is best to treat expectantly, simply ascepticizing and dressing the outer wound or wounds. The same authority states that if profuse hemorrhage occur, the wound should be enlarged, and the surgeon proceed to treat as in stab wounds of the chest.

American surgeons do not agree with Abbott, on account of the great danger of sepsis. Lucas Championière treats gunshot wounds of the thorax by refraining from interfering with the wound, simply applying antiseptic dressings and immobilizing the chest. He says the least interference greatly adds to shock, which may result fatally. Summers states that the best treatment for gunshot wounds of the thorax — that is, those which penetrate the chest-wall and lung — is the administration of opium internally and the application of antiseptic dressing on the wound. If the chest-wall is at all lacerated, hemorrhage should be controlled, all loose fragments of ribs and any foreign body discoverable removed, and drainage provided. If the bullet has passed through the chest and lodged under the skin, it can be removed, but it is not a wise thing to explore or probe with the finger to locate a bullet in the lung, as there is grave danger of causing hemorrhage or infection. All competent surgeons

positively prohibit the use of finger or probe in exploring for bullets.

Secondary operations in the pleural cavity or in the lung are better and safer than too active interference in primary dangerous wounds. Unless dyspnœa points to impending death from loss of blood and its accumulation in the pleural cavity, operative surgery is not necessary. Absolute rest should be ordered, and this is best carried out in times of war by strapping the chest with surgeon's adhesive plaster, completely immobilizing the injured side, thus controlling hemorrhage and giving the patient complete rest and comfort. If the hemorrhage is thought to be from an intercostal or the internal mammary artery, it should be exposed and tied.

Von Langenbeck's method of controlling hemorrhage from a wounded intercostal artery is excellent, and consists in introducing a gauze tamponade into the pleural cavity, tying tight against a compress on the outer surface of the chest-wall and securing it there, thus closing the artery by compression. Matas states that bleeding from an intercostal vessel is frequently overlooked on account of being concealed and internal, and reports the deaths of two patients from concealed hemorrhage from internal mammary, one of which he believes might have been saved by prompt operative interference.

Resection of a rib for intrapleural hemorrhage, in temporary or field hospitals, is a dangerous procedure, and is to be condemned on account of the impossibility of preventing sepsis. It is far better to keep the patient quiet, and if pressure from bleeding become too great, aspirate, and aspirate again if necessary. If empyema develop later on, as may be the case, then, of course, a resection of rib, in a properly arranged and furnished hospital, is the operation of choice.

A gunshot wound is not likely to become infected unless some of the soldier's clothing is carried into the wound, but with the small-caliber bullet now in use, there is seldom any danger from that source.

The first results observed of primary healing are not to be taken as final, for, according to Greenleaf of the United States army, many of those cases later on develop an infection, due to the carrying in of foreign bodies, such as soldier's clothing and other foreign material. In the statistics of 24 cases, 9, or 38 per cent, showed most serious results, such as empyema, due, no doubt, to bad care, lack of hospital protection, poor transportation, tropical rains, wet, exposure, improper feeding, and lack of nurses to attend to the wants of the patient, thus necessitating his taking care of himself, which resulted in the disturbing or breaking down of the blood-clots, the lowering of the vitality, and providing conditions favorable for developing infection in the blood-clot — an excellent culture media. An interesting point brought out by Greenleaf is that hæmothorax developed in some of the cases on the twelfth day, due to the bad care above referred to. The conditions mentioned were in wounds inflicted during the Spanish-American War, in cases cared for in Cuban hospitals, where the baneful effects of the tropical climate were felt, as well as the lack of adequate preparation that so unfortunately was the case in the campaign at Santiago; thus pointing out the great necessity for proper care and attention of patients suffering from injuries to the chest in time of war, as they are very dangerous wounds.

In permanent military hospitals, the X-ray is a valuable agent in locating bullets and other foreign bodies, and, it goes without saying, it is a great aid in military surgery.

Large, open wounds inflicted by sabers, bayonets, shells, and shrapnel, and other forms of penetrating and lacerating wounds, are fatal in proportion to the severity of the injury inflicted, and should always receive prompt surgical intervention to control hemorrhage and to repair the damage done, as far as possible, as soon after the injury as the patient can be removed to a dressing-station.

Gunshot and saber wounds of the heart and aorta, involving all the coats, will give a very high mortality, and allow very little chance for surgical intervention. In the Civil War, wounds of this character gave a mortality of 99.9 per cent. At short range, wounds of the heart and large vessels show that these organs are rent into fragments by the small-caliber bullet, thus demonstrating that it is quite as destructive as the old large-caliber bullet, if not more so.

Contusions of the thorax, when slight, require very little care, other than that involved in rest and the time necessary to secure recovery. In more serious injuries of the thorax, accompanied by simple fracture of the ribs with penetration of lung, and followed by emphysema, excellent results have followed, in civil practice, a free incision over the injured part, resection or removal of the penetrating rib, and the tamponade of the wound in the lung, with thorough aseptic dressing.

In military practice, in a fairly well-organized field-hospital there is no reason why this procedure should not be followed with good results. If this method is not resorted to, there is an excellent chance for infection, through the open bronchi and secondary infections, which may prove fatal.

One of the greatest and most valuable advances made in military surgery is the use of the first-aid package on the battle-field. This package, in approved form, is now supplied to all well-organized armies, and should be inspected frequently, and if found damaged, reissued to each soldier before going into battle. When properly used, it is of invaluable service in saving lives. The hermetical sealing with collodion of wounds of entrance and exit, as practised by civil surgeons, it is believed, will not prove practical on the battle-field; therefore dependence must be placed entirely on the first-aid package, and on its intelligent use by the soldier himself or those nearest, when wounded in action.

Volunteers and regulars should be thoroughly instructed by competent surgeons in the use of the first-aid package, and the instructions repeated at frequent intervals, in order to familiarize them with its use. This is particularly applicable in this country, in the case of volunteers. With the large number of wounded that rapidly accumulate in a hotly contested engagement, many valuable lives may be saved by the timely use of the first-aid package.

In gunshot wounds of the neck, as previously stated, as well as in all wounds of the thorax, where they are not instantly fatal, the intelligent use of the first-aid package is a valuable life-saving agent. As Senn has pointed out, these wounds should be hermetically sealed with care as soon as possible. This timely precaution, in military practice, cannot be too often referred to, in order to be thoroughly understood.

In my own experience in civil practice, in dealing with gunshot wounds of the thorax, the manner of treatment is to sterilize thoroughly the wound of entrance and exit, and then to seal hermetically with ten-per-cent iodoform and collodion occlusive dressing. Even in cases where there is excessive hemorrhage, and the patient's life wavers in the balance, recovery usually follows without complications, if the wound does not prove fatal from the injury to very large vessels. These favorable terminations are, no doubt, due to the fact that the patients are treated in well-regulated hospitals or in comfortable homes, and are kept absolutely quiet until recovery is complete. In civil practice the treatment of these wounds has been very materially aided by thorough immobilizing of the thorax, either by the use of adhesive plaster strapping or plaster-of-Paris casts, and absolute quiet and rest in bed, and no other surgical intervention.

EDITORIALS

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Managing Editor - FRANKLIN H. MARTIN, M. D.
Associate Editor - ALLEN B. KANAVEL, M. D.

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METHODS OF DILATING THE CERVIX UTERI AT TERM

The question of artificial dilatation of the outlet of the pregnant uterus at or near the termination of gestation has occupied the attention of obstetricians within the last year or so to an uncommon extent. Bossi, with his metallic instrument, on the one hand, and Dührssen, with his vaginal Cæsarean section, on the other, have stimulated an animated discussion which has included all the methods of the so-called accouchement forcé. At the Boston meeting of the American Medical Association this year, at the Hot Springs meeting of the American Gynecological Society, and at the September meeting of the Chicago Gynecological Society, this subject was discussed in symposium. From the various views and conflicting practices of eminent authorities, some conservative generalities can be gathered to guide the practical obstetrician in his estimate of the indications and his choice of the most eligible methods.

The bloodless methods of dilatation of the cervix comprise three general varieties: by the hand; by the bag or balloon; by the metallic branching dilator. The story of manual dilatation is as old as the history of obstetrics, but the methods of Philander Harris and of Edgar are the best. The former consists of the introduction into the os of the index finger, then the thumb, separating these as in the act of snapping the finger, then introducing the other fingers in order and opposing them to the thumb. The tips of the fingers are hooked, and so the pull is downwards, in the physiological direction. Complete dilatation can be obtained by this means, but it is usually better, as soon as four fingers can be introduced, to employ the method of Edgar. The latter consists in passing the index and middle fingers of each hand with their backs opposing and pulling them downwards and apart. The manual methods possess the advantage of convenience, of safety, and of perfect control by the operator. They are fast enough for almost all cases. They are especially adapted for placenta prævia, where quick delivery may be desirable. The dangers in all the methods of rapid dilatation of the cervix of the pregnant uterus lie in the haste which the operator desires. Conservatism requires that the danger from haste shall not be greater than the original condition which was the indication for the operation. The rule should never be as much haste as is possible, but as much haste as is safe. The danger to the mother from the complication calling for the interference is very rarely so great that the obstetrician is justified in running great risks in attempting to deliver her speedily, from the method of delivery itself.

Where haste is a less desideratum, where one safely has hours instead of minutes, the bag

method is the best. The Barnes type is obsolete. The Braun type — that of the elastic rubber bag — possesses no advantages over the non-elastic balloon of the De Ribes type and has many disadvantages of its own. The latter type consists of a conical non-elastic bag, which can be introduced within the uterine cavity. It then acts in three ways: as an artificial bag of waters, by means of the uterine pressure from above; as a stimulus to the post-cervical ganglia; as a moving wedge when traction is brought to bear upon it from below. It is the safest of all the methods, but is not adapted to those cases where great haste is imperative. Its best indication is in placenta prævia. Here it prevents hemorrhage by means of pressure upon the uterine surface from which the placenta has been detached, and at the same time aids in dilatation. Bag dilatation is the most nearly physiological of all methods.

During the last few years the metallic dilator has been one of the most discussed instruments in the obstetrical armamentarium. For our purpose, only the branched dilators are to be considered. The instruments of Goodell and of Ellinger and the three-bladed écarteur of Tarnier have long had a limited use as dilators of the parturient cervix. Since the introduction of the De Ribes balloon, Tarnier's instrument has had a much more limited indication. It has, however, an advantage over the screw instruments, in that the force of the dilating is furnished by an elastic rubber band put around the handles. It pays for this advantage of relative safety in being slower.

Interest has been revived in the branching metallic dilators by the vogue which the instruments of the Bossi type have recently obtained in Germany and in this country. The essential principle is the spreading of from four to eight rigid blades under the action of a screw at or near the distal end. Much of the favor with which the instrument was received has been due to the enthusiastic approval which Leopold of Dresden has given to it. It was comparatively unknown outside of Italy until he took it up and brought it to the attention of German obstetricians. Since then, modifications of the Bossi principle have been invented by scores of imitators and improvers.

It cannot be denied that the Bossi instrument effects dilatation quickly, but it cannot be denied by the thoughtful that the quickness is gained at the expense of safety. On the authority of Hammerschlag, Schauta (Cristofoletti), Bardeleben, and others, it appears that there is great danger of extensive lacerations of the cervix extending upwards into the lower uterine segment. Bardeleben showed, by his later examinations of women in his out-patient clinic, that the permanent results of the lacerations were worse in those upon whom the Bossi instrument had been used than upon those who had undergone spontaneous labors. The speed in accomplishing the delivery does not seem to be sufficiently superior to that from manual means to justify, except in the rarest instances, the greatly increased dangers of traumatism.

While Bossi was employing his instrument in Italy, Dührssen was advocating and practising deep incisions of the cervix as a means of accouchement forcé. His idea was to eliminate the dilating stage of the labor and bring the patient at once into the second stage, so that the remainder of the labor could be hastened by forceps or other obstetric operation. Eclampsia was here, as in the Bossi procedure, the chief indication, although other reasons for hastening delivery also came into consideration. His principle differed from the older method of multiple incisions of the borders of the os, in that he advocated cutting deeply enough to eliminate entirely the cervix, making usually four incisions. The deep cervical incisions can only be undertaken after labor has been in

progress, at least, long enough for the cervix to be well taken up and thinned. Dührssen recommended and practised these incisions for cases where immediate delivery was indicated, especially cases of eclampsia. Since the incisions are adapted only for cases where the cervix is nearly obliterated and where labor has been in progress some time, Dührssen proposed what he calls "vaginal Cæsarean section." This consists in separating the anterior uterine wall from the bladder, opening into the posterior cul-de-sac, and continuing the incisions in front and behind well into the lower uterine segment. By many it is considered unnecessary to make the posterior incision. By the operation one is enabled to deliver at once via the natural passages, by forceps, version, or other means. Afterwards the incisions are to be as carefully sutured as in abdominal Cæsarean section. Actual priority in the performance of the operation probably does not lie with Dührssen, since others performed it before he actually did.

The older method of making multiple small shallow incisions in the margin of the os to hasten dilatation has practically been abandoned. None could tell beforehand how much further any of these cuts would tear as the fœtus passed through, and there were frequent extensive tears into the uterine wall itself. Vaginal Cæsarean section and the Dührssen incisions cut intentionally far enough to provide fully for the exit of the fœtus, and therefore no more can be torn. Practically, these two represent all the useful measures of bloody dilatation of the parturient cervix uteri.

The indications for cervical incisions are extremely limited, in the opinion of the vast weight of conservative authority. They would be limited to cases where quick delivery was considered imperative as a life-saving measure in the interest of the mother, such as uncompensated heart disease, eclampsia, internal concealed hemorrhage, etc., where manual dilatation failed. It is well, also, to remember that even in eclampsia it is rare to have the indication for immediate delivery so urgent that dangerous operative interference is permissible. There are other factors in eclampsia besides the presence of the fœtus in the uterus.

Vaginal Cæsarean section can be performed at any period in the labor, or even in the pregnancy, whether the pains have begun or not; whether the cervix has been obliterated or not. It is, no doubt, a fascinating operation to do, and satisfying as a piece of obstetrical gymnastics. A growing number of conservative obstetricians, however, cannot see wherein it is better than the classical Cæsarean section. Under modern conditions the mortality from the latter has been reduced to a minimum, and it is really not a difficult operation to one skilled in abdominal work. It is surely much easier to close the uterine incision from the abdomen than to work high up in the dark vagina, placing sutures. Again, if it should be deemed necessary, for any reason, to remove the whole uterus after emptying it, that operation is easier and safer by way of the abdomen than by way of the vagina. The hemorrhage, which is one of the chief dangers in all Cæsarean sections, can be much more easily controlled from above than from below.

The multiplication of instruments for bloodless dilatation of the cervix in late pregnancy and labor and the perfection of operative technique of a bloody character must not lead the obstetrician from a wise conservatism. The rules in obstetrics still remain: Do nothing without indications; do no more than the indications warrant; do not in the least particular sacrifice safety for speedy delivery, however imperative that seems. HENRY F. LEWIS.

DEPARTMENT OF TECHNIQUE

COOK COUNTY HOSPITAL

Department of Surgery

THE SURGICAL TREATMENT OF APPENDICITIS AT COOK COUNTY HOSPITAL

By CHARLES DAVISON, M. D., Chicago

Professor of Surgery and Clinical Surgery, College of Physicians and Surgeons, University of Illinois; Attending Surgeon to the Cook County and the West Side Hospitals

At Cook County Hospital all cases of appendicitis entering the hospital are assigned to a surgeon for surgical treatment, and those in the writer's service are operated on, unless there are complications which prohibit the operation or make it extrahazardous.

The operation for acute infectious appendicitis is considered an "emergency operation," and is performed as soon as the diagnosis is established, night or day, with the same expedition as for strangulated hernia, gunshot of the abdomen, or other serious injury. The early diagnosis of acute infectious appendicitis is established by the combination and sequence of four cardinal symptoms, as follows:

1. Abdominal pain, diffuse and colicky in character, immediately followed by
2. Nausea or vomiting, and in twelve to twenty-four hours by localization of
3. Pain, tenderness, and muscular rigidity at McBurney's point, and accompanied by rise of
4. Temperature.

These symptoms, in their relation and sequence, indicate some form of acute inflammatory disease of the appendix.

For convenience in determining treatment, acute infectious appendicitis may be separated into several classes, according to the pathological condition of the appendix and its surroundings.

1. Simple acute infectious appendicitis, in which the principal pathological condition is infection and inflammation of the lymphoid tissue of the appendix. These cases are operated on at once because there is no method of diagnosis to distinguish them with certainty from the more serious and fatal forms, and because there is always a possibility that the infection may not remain limited, but may spread and produce a rapidly fatal general peritonitis. Without delay, with only the preliminary preparation of the operating-room, the appendix is removed.

A short incision through the abdominal wall in the linea semilunaris is made. The cæcum is lifted to the wound, and the appendix and that portion of the intestine to which the mesoappendix is attached are delivered through the incision in the abdominal wall, which should be small enough to hold the intestine in position, like a buttonhole, during the subsequent manipulations.

The circulation through the mesoappendix is tied off with catgut ligature. (Fig. 1.) The appendix is freed to its base by incision through the tied mesoappendix. A clamp is used on the appendix to prevent infection from distal leakage. The appendix is cut off almost flush with the cæcum.

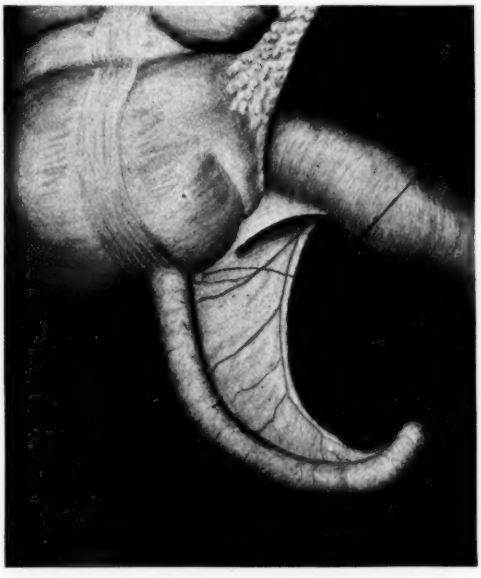


Fig. 1. Ligation of mesoappendix.

Fig. 2. Deep purse-string suture penetrating all layers of cæcum, loosely in place, to be tied after appendix is cut away.

A purse-string suture of catgut is applied to the cæcum just away from the base of the appendix. With dissecting-forceps an assistant inverts the edges of the opening as the purse-string is tied. (Fig. 3.)

For convenience, the purse-string suture is put in place loosely before the appendix is cut away. (Fig. 2.)

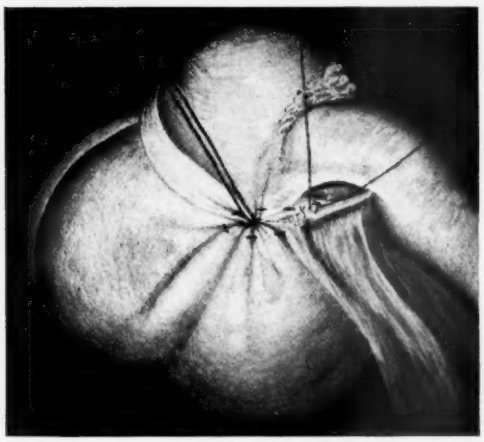


Fig. 3. Deep purse-string suture tied, and peritoneal purse-string suture loosely in place.

Fig. 4. Diagram showing deep purse-string suture passing through all layers of cæcum and under small occasional artery.

The purse-string begins at one side of the cut mesentery and passes underneath it, so as to constrict a small artery that is often present at that place. (Fig. 4.)

The purse-string passes through all layers of the cæcum, so that when tied over the inverted cut edge it constricts all divided intramural blood-vessels and prevents reactionary hemorrhage into the lumen of the bowel. (Fig. 5.)

The ends of the tied purse-string are used to steady the cæcum while a superficial purse-string is placed.

A Lembert purse-string suture surrounds the

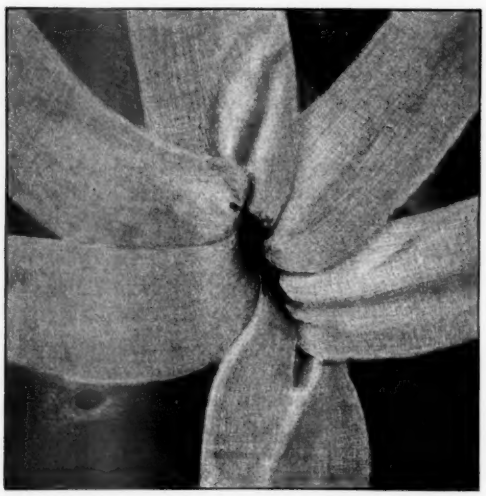


Fig. 5. Coffer-dam of iodoform-gauze surrounding abscess.

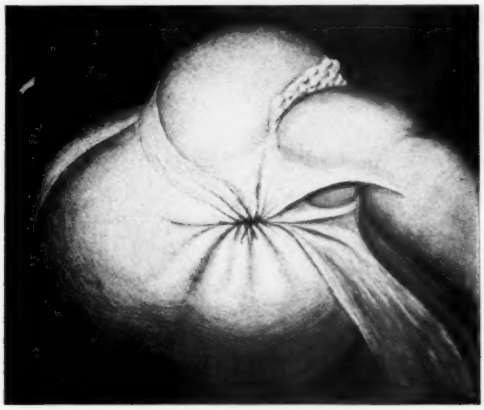


Fig. 6. Peritoneal purse-string suture tied, covering all denuded surfaces.

knot of the deep purse-string, and the ligature holding the vessels of the mesoappendix. (Fig. 6.) These knots and the cut edges of the mesoappendix are inverted, and covered with peritoneum when the second purse-string suture is tied.

In this method all mucous membrane drains into the cæcum, and there is no infected stump of the appendix left buried in the cæcal wall. The repaired cæcum is replaced and the abdominal wall wound repaired with removable longitudinal silkworm-gut sutures,[1] the usual dressings applied, and the abdominal wall immobilized by broad bands of adhesive plaster.

As soon as the ether nausea has subsided, cathartics are given, followed by enemata, and as soon as a free bowel movement has been secured the patient is considered convalescent.

2. Suppurative appendicitis, that form in which suppuration has occurred, resulting in

(*a*) Appendicular empyema.

(*b*) Periappendicular abscess.

Empyema of the appendix is treated by appendectomy, great care being used to avoid rupture of the appendix and infection of the peritoneal cavity.

Periappendicular abscess is treated by drainage. If the abscess is recent, a free incision is made in the linea semilunaris, so as to avoid the abscess and enter the free peritoneal cavity. A coffer-dam of iodoform-gauze (Fig. 7) is made around the tumor in such a manner as to protect the peritoneal cavity from infection, the abscess is teased open with the finger, wiped out with dry gauze sponges, and a twisted gauze drain inserted to the bottom of the abscess. The appendix is not disturbed, unless it can be removed without interfering with the integrity of the abscess-wall, when it is simply tied and cut off. When not removed at the drainage, the appendix or its remnants are taken away at a subsequent operation.

At the completion of the drainage, hot wet boric dressings are applied and frequently repeated. The twisted gauze drain can be replaced with fresh gauze, as necesssary. The iodoform-gauze coffer-dam is allowed to remain from five to seven days without being disturbed, after which it is raised one or two inches each day until removed.

Old appendicular abscesses that are adherent to the anterior abdominal wall are opened by careful dissection through the wall directly over the tumor in the adherent area; the abscess is wiped out with dry gauze sponges and drained by twisted gauze drains.

3. Perforative appendicitis.

(*a*) Perforation of the appendix without limiting adhesions.

(*b*) Perforation of the appendix when surrounded by old adhesions.

Perforation without surrounding adhesions usually occurs at a primary attack, and the contents of the appendix are discharged directly into the free peritoneal cavity, quickly producing acute general suppurative peritonitis. This serious condition is treated by free incision through the linea semilunaris; the fluid is carefully wiped out with gauze sponges. Every effort is made to avoid spreading the infection by manipulation.

A tube-drain extending just through the abdominal wall is placed in the right flank to drain the ileocæcal fossa. The pelvis is drained by a quantity of strips of twisted gauze and by counter-opening from the vagina in the female.

Strips of gauze are placed in different directions, as the judgment indicates in each case.

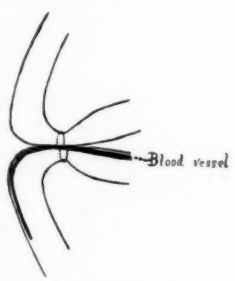


Fig. 7. Diagram showing deep purse-string suture tied, turning into cæcum all raw surfaces, and controlling all hemorrhage.

[1] Annals of Surgery, March, 1902; SURGERY, GYNECOLOGY AND OBSTETRICS, Jan., 1906.

The appendix is delivered, ligated, cut off, and the stump anchored by the ligature to the peritoneum at the right edge of the abdominal wound.

A quantity of strips of twisted gauze is passed to the ileocæcal fossa.

The wounds are covered with large quantities of hot wet boric dressings, which are changed at frequent intervals.

The patient is placed in a bed, with the head of the bed elevated 26 inches from the level. A normal salt hypodermoclysis is given at once, and repeated every four to six hours until the patient rallies from the sepsis. A continuous normal salt enema is given, with or without whisky, according to the condition of the patient. Strychnine hypodermically is given freely, 1-30 grain, every half-hour to four hours, according to the condition of the patient. If the patient improves, the stimulants are reduced.

No food or fluid is given by the stomach until the patient is convalescent. When necessary for nutrition, beef peptones are added to the enemata.

If there is severe vomiting, the stomach is washed at intervals.

The drains are allowed to remain until all general infection has subsided, when they are gradually removed. If fæcal fistula occurs, it generally heals spontaneously.

Perforation of the appendix, draining into a mass of old adhesions produced by previous attacks of inflammation, results in periappendicular abscess, and requiresdrainage similar to the suppurative form.

4. Gangrenous appendicitis is treated by free incision through the linea semilunaris and free drainage. The secretions are carefully mopped up with pledgets of dry gauze; a coffer-dam of iodoform-gauze is placed around the cæcum; the appendix is ligated with catgut and cut off, and the stump anchored in the abdominal wound.

Hot wet boric dressings, elevation of bed, stimulants, and saline solution are used according to the severity of the individual case.

The operations for the chronic forms of recurrent and relapsing appendicitis and secondary attacks of appendicular colic are considered operations of safety, convenience, and comfort, and the patient is subjected to careful preliminary preparation before the operation.

The appendix is amputated in as nearly a typical manner as its adhesions and distortions will permit. All denuded surfaces and torn adhesions are covered by peritoneum to prevent any opening for infection or any post-operative adhesions.

AN AID IN ANÆSTHESIA IN CASES OF NASAL OBSTRUCTION

By G. M. CUSHING, M. D., Chicago

Every surgeon of even moderate experience has occasionally come in contact with cases that take their anæsthetics badly because of some nasal obstruction. At times these obstructions originate inside the nose, and at other times the chief interference with breathing arises from a flap or valve like action of the alæ nasi, which almost or entirely closes one or both of the nasal orifices when the patient inspires.

It is in such cases that the ordinary wire hairpin becomes a surgical instrument. The pin is bent in the form of a letter M, and inserted into the nasal orifices. The central part rests against the septum, while the lateral wings rest one in each ala, holding it open, thus holding them open, so that respiration is carried on with perfect freedom. It will be noticed that the method of bending the pin or wire prevents its being lost in the nasal cavity.

I claim no originality in the use or discovery of this instrument, but, never having seen it described, and having found it so meritorious and successful in my own practice, I take the liberty to describe it here.

TRANSACTIONS OF SOCIETIES

TRANSACTIONS OF THE CHICAGO SURGICAL SOCIETY

A regular meeting was held December 7, 1906, with the President, DR. D. W. GRAHAM, in the chair.

SYMPOSIUM ON MILITARY SURGERY

Papers were read as follows:

1. ANCIENT MILITARY SURGERY, by DR. NICHOLAS SENN.
2. SURGERY OF THE HEAD, by DR. CHARLES ADAMS. (See paper, *ante*, p. 192.)
3. SURGERY OF THE NECK AND CHEST, by DR. T. J. SULLIVAN. (See paper, *ante*, p. 220.)
4. SURGERY OF THE ABDOMEN, by DR. E. WYLLYS ANDREWS. (See paper, *ante*, p. 215.)
5. PRIMARY FIELD DRESSING OF WOUNDS, by DR. P. J. H. FARRELL. (See paper, *ante*, p. 217.)

DISCUSSION

MAJOR A. E. BRADLEY: I desire to thank the Society for the privilege of listening to these admirable papers this evening and of being with you.

A few ideas occurred to me while I was listening to Dr. Senn and the other essayists. Reference was made to poisoned arrows and the wounds caused by them. In this connection, I wish to say that in the Philippines some of the non-Christian tribes use poisoned arrows, using for their poison the ptomaines of putrid chicken. The head of the arrow is dipped into this chicken mass, permitting the ptomaines or solution to dry on the head of the arrow, thereby causing disastrous effects to those who are pierced by the arrows.

In taking up the subject of military surgery, we have to remember that the conditions in the field are such that it is practically impossible to secure asepsis or antisepsis; therefore our rule is conservatism. I believe that is the rule, to-day, of all military surgeons — to be as conservative as possible; to interfere as little as possible.

Speaking of the rule which has been laid down as to interference, one should ask one's self this question, Will sepsis give a man less trouble than the condition which already exists? If you take it for granted that you will have sepsis in a given case, and if the sepsis be less dangerous than the existing condition, then operate. If not, wait until you can get the patient to the best well-equipped hospital, where you can be sure of your asepsis, getting him back as quickly as possible, depending on the transportation facilities provided for before the engagement.

As to the first-aid dressing and the use of powders, I will say that the first-aid dressing, as issued by the medical department of the army, contains no powders at all. One of the speakers — Dr. Farrell, I think — referred to the use of iodoform. We find that iodoform sometimes causes dermatitis and irritation, which, if possible, should be avoided in these cases. The medical department has recently issued a new first-aid package, the containing-case of which is made of metal, hermetically sealed, and is opened only in cases of emergency. A case is issued to each man, who is held responsible for it. If he should lose it, it is charged against him, and another one is issued. The dressings are all arranged in this package so that they can be put on wounds without much if any disturbance.

We have heard a good deal of late about the success of the Japanese in their war with Russia. According to some figures which I have been able to obtain recently, of their wounded in the Second Army, 16 per cent died. That compares unfavorably with our own results in the Spanish-American War, where we, of our wounded, lost only 6.6 per cent. In the general comparisons that have been made, the good results obtained by the Japanese have been largely attributed to sanitation.

Dr. Farrell spoke of the casualties occurring among members of the medical department. It is not usually understood that we, as a non-combatant force, are sustaining the losses which we have had in the Philippines in recent years. Since this insurrection we have lost more, in proportion to number in the medical department, than in any branch of the service. In the recent war of the Russo-Japanese, the loss to the sanitary corps was 5½ per cent, and the loss to the surgeons alone, 4.66 per cent of the total number wounded. This shows that the medical departments of all our armies are going right up to the front and sustaining their wounds and injuries with the others.

Dr. Andrews spoke of the importance of opening the abdominal cavity in cases of gunshot wounds. I think all army surgeons are in direct

accord with his view. This is done, and we expect to do it always, in garrison work, where the conditions are such that we can do clean surgery. In the field, however, the rule of conservatism holds with us: the less done to these wounds, the better the chance for the recovery of the wounded.

In speaking of wounds inflicted by the bayonet, the ordnance department, within the last year or so, was about to issue the new rifle known as the Springfield. As at first manufactured, it had a rod bayonet. Before it was ready to be issued, however, the Russo-Japanese War came on, and reports were received in great number as to the wounds inflicted by this bayonet by the engaged armies. With the consent and advice of the general staff, the rod bayonet was withdrawn. We have gone back to the knife bayonet, and it is now being issued to troops. The medical department now keeps on hand a certain number of field supplies for emergencies, possibly not sufficient to meet the early demands of a great war, but at least enough so that we shall not be entirely unprepared if called upon in the near future to meet an enemy.

TRANSACTIONS OF THE CHICAGO GYNECOLOGICAL SOCIETY

FRANK W. LYNCH, Editor

A regular meeting was held November 16, 1906, the President, Dr. Junius C. Hoag, in the chair.

Exhibition of Specimens

CALCIFIED OVARIAN TUMOR

Dr. Frank T. Andrews: I wish to exhibit a specimen of exceeding interest. It is a calcified ovarian tumor. The wall of this ovarian tumor, or cyst, is not only calcified, but it is also ossified. Some microscopic slides here show the bone. The specimen was removed from a woman 37 years of age, married, who has three children. This cyst might be readily mistaken for a corpus luteum cyst, but I have not been able to prove it such. It contained about a dram of solid matter in the form of a paste, but the microscopical examination shows no structure. There are no hairs, nor anything resembling sebum or epithelial cells. The soft part of the tumor is a cut with a knife, and at the bottom of this cut you will find a normal corpus luteum. I have not made a detailed search of the literature, but I have looked through the text-books on pathology, and the only reference to anything resembling it is in Gebhard, in the chapter devoted to the changes that take place in ovarian cysts. He describes a cyst the size of a small apple, with cyst-wall one centimeter in thickness, with a cavity in the center, which he attributes to liquefaction and softening of the tumor, with the consequent production of a cavity. He makes no mention of a microscopic examination.

CALCIFIED FIBROID TUMOR

I present a calcified fibroid tumor removed from an old woman, the only reason for removal being that it rested and bore directly upon the rectum in such a way that the patient suffered from intense rectal pains. Some other smaller tumors were left at the operation.

VESICAL CALCULUS

I brought this vesical calculus along because it was removed from a girl, 18 years of age, by litholapaxy. It contains phosphatic stones, with one urate layer between some of the phosphatic layers. It also contained an oxalate of limestone.

ABSCESS OF THE OVARY

Dr. T. J. Watkins: This is an abscess of the ovary, in which the liquid part of the pus has absorbed and has left the contents a solid caseous mass. The abscess formed about one year before operation. It is about three inches in diameter, and was two or three times larger than here shown when I saw her during the acute stage of the disease.

HYDROSALPINX

I have here a unique specimen of a hydrosalpinx. This specimen is of interest: 1. On account of the very thin wall of the tube; and 2. On account of the size of the tube. Measurement shows the tube to be 27.5 cm. long; circumference at largest point, 23 cm. It also showed that the distended part of the tube was almost entirely confined to the ampullar portion; dilated portion, 11 cm. long. The musculature of the tube is all atrophied and absorbed, leaving only a thin peritoneum and mucous membrane covering. The wall of the tube is as translucent as the amniotic sac of a two or three months' pregnancy. Weight, 245 grams.

Dr. Albert Goldspohn: The method Dr. Watkins has described in dealing with the broad liga-

ments in cases of fibroid tumors I have had occasion to use almost as a matter of necessity in several cases. As the tension of the broad ligament is relieved thereby, one can get at the vessels and ligate much better after the tumor has been partially enucleated. You can usually find some one phase of the tumor where such enucleation can be quite readily done without interfering with the blood-vessels.

Exhibition of Instruments

modified uterine curette

Dr. Joseph B. De Lee: I wish to exhibit a modification of the ordinary uterine curette, with a view to making it easier to hold when one uses rubber gloves. In order to get a firm grasp of the curette when one uses rubber gloves and lysol, it is necessary to use a good deal of force, which destroys tactile sensibility and the delicate touch one needs to have in such cases. I have therefore had a ring put in the handle of the ordinary uterine curette, with the idea of making the grasp firm and delicate at the same time.

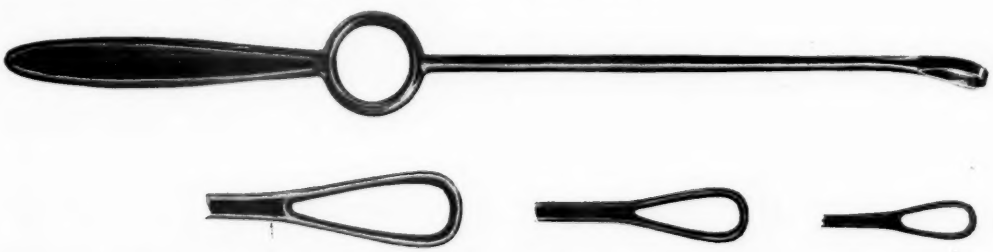
Reports of Cases

hæmatoma of the vulva and vagina

Dr. Joseph B. De Lee: Before reporting the case of Cæsarean section, I want to show you a photograph of a recent case of hæmatoma of the vulva and vagina.

The woman whose case I report entered Mercy Hospital with a diagnosis of threatened eclampsia. In the urine there were albumin, casts, and white and red blood-cells. She also had certain toxic symptoms, which one internal medical man diagnosed as scurvy. Her gums were swollen and bleeding, with general prostration, which he ascribed to scurvy. I doubted very much if it was a case of scurvy, because she belonged to the better class and had always had good food and care, but thought the findings were of a toxæmic nature. We induced labor, after waiting until the child was viable, in accordance with the tenets of the Catholic Church. Labor progressed naturally, without any apparent difficulty. The child came by the breech and lived two or three days. Eight or ten hours after delivery this condition was found: The woman was in a state of marked anæmia, so that it seemed as if dissolution was impending from loss of blood. On examination, we found a hæmatoma of the vulva, which surrounded the rectum and extended up on to the posterior wall of the pelvis to the promontory of the sacrum, completely filling the pelvis and pushing the vagina to the right side. The uterus was contracted, and there was no blood in it. The treatment was simple. The woman was given large amounts of saline solution, and an incision fully eight inches long was made in the tumor, extending from the cervix down to and alongside the rectum, deep into the ischiorectal fossa. About a quart of clotted blood was removed, and the cavity packed with sterile gauze. The woman made a slow recovery from the effects of the anæmia and from sepsis, and went home well.

Large hydrosalpinx, with thin translucent wall and few adhesions. (From Watkins.)



Curette of Dr. DeLee. The three tips are actual size. The curette is reduced one half.

CÆSAREAN SECTION FOR ECLAMPSIA — DEATH OF CHILD FROM ECLAMPSIA — REPORT OF PATHOLOGICAL FINDINGS

DR. JOSEPH B. DE LEE: The case I wish to report is the first case of Cæsarean section on the living that has been done in this city, so far as I know, for eclampsia.

The woman was a primipara, aged 24, a Pole, who had been in this country a very short time. She had convulsions, beginning at nine o'clock of the day before she entered the hospital. She entered Provident Hospital at nine o'clock in the morning, and was having convulsions every ten to fifteen minutes. She was deeply comatose; there was a moderate degree of cyanosis; pulse ranged from 108 to 120. There was considerable œdema, and an examination of the urine showed characteristic findings — 8 per cent (by Purdy) of albumin. There were only a few ounces of urine in the bladder; there were casts of all kinds, with red and white blood-corpuscles. I saw her at eleven o'clock. She had had, before I saw her, nine convulsions while in the hospital, and within two hours. She was eight months pregnant. An internal examination showed that labor had not begun, although she was beginning to have weak contractions. The cervix was very small and closed, so that it was only with difficulty that I could insinuate the tip of my index finger into it. I ruptured the membranes, and ordered that she be given a quarter-grain of morphia hypodermically, and thirty grains of chloral per rectum; I also ordered hot sweats and saline solution hypodermically. The condition of the patient was improved for an hour afterwards; she did not have convulsions after the examination, which was conducted under chloroform anæsthesia. However, the convulsions recurred, and at one o'clock she was having them regularly every ten minutes. Cyanosis was extreme; pulse 128; temperature 101°. I decided that interference was necessary and urgent, and attempted vaginal Cæsarean section. After everything was prepared, however, I found it was impossible to do vaginal Cæsarean section, for as soon as I would put a vulsellum forceps on the cervix it would pull out as if it had been put in butter. A suture put in the cervix fell out, and I do not know how it came out. It was like putting a suture in butter and tying it. The field of the operation was so flooded with blood all the time, that I found it absolutely impossible to proceed with the operation. It was not the first operation I had done; it was the sixth I had attempted; the remaining five were successful. I therefore gave up the vaginal operation. I did it because I feared that if I went ahead blindly I might cut into the bladder or peritoneal cavity; and furthermore, I feared that I could not stop the hemorrhage. I did not attempt rapid dilatation of the cervix, because I felt that I did not know how far the brittle friable tissues would tear. The abdomen was rapidly prepared, and abdominal section was done. It was necessary to make a longer incision than is usual, on account of a double-horned uterus; not a complete double horn, but an indication of it — a marked uterus arcuatus. The child was delivered without any trouble. It was a placenta prævia Cæsarea. Having to come right through the placenta, the child was slightly asphyxiated, or perhaps only apnœic. It was artificially resuscitated, successfully, and cried shortly afterward. There was not anything particular about the Cæsarean section. An anterior median incision was made, and the uterus was sewed in three layers. The whole operation, from start to finish, took an hour. The woman's pulse on the table was bad; it was bad before I started the operation; it was 140 to 160, and we gave her salt solution after she went back to bed. I allowed her to bleed profusely. The blood had a peculiar color; it looked like thick port wine. After the operation the temperature went to 104° F. in the evening; the convulsions became less frequent, less severe. She had fifteen convulsions after delivery, and it seems that the convulsions stopped after the administration of veratrum viride; the pulse ranged from 150 to 160. I administered veratrone, which is a pure preparation of veratrum viride, in ten-drop doses, until the pulse came down to 100, and the effect was satisfactory. There were no convulsions after that, and she made the usual post-eclamptic recovery. On the third or fourth day I inspected the line of abdominal incision, and it was perfect; but, later, the woman pulled the lower sutures apart; one inch of the incision suppurated, but has since closed, and the woman is about ready to leave the hospital.

As to the baby, it lived up to the fifth day, during which time I do not remember ever having seen a healthier baby. It weighed four pounds two ounces. There were no signs of intracranial injury; the child was bright; it nursed vigorously; it had no elevation of temperature; the bowels moved, and the stools were yellow; but on the morning of the fifth day it began to have convulsions, and after the fifth convulsion, about noon, it died.

Dr. Grulee, pediatrist of the hospital, has made sections of certain parts of the child; has examined the urine which was found in the infant's bladder, and will present his report.

A few words about Cæsarean section in cases of eclampsia. Halbertsma, in 1889, published an article in which he recommended the operation, and up to 1902 the latest collected statistics I could find were those of Streckeisen, who collected fifty-six cases of Cæsarean section done for eclampsia. Many more of these operations have been done since then. Olshausen has done quite a few in Berlin. The question arises, whether Cæsarean section is a justifiable operation in eclampsia. I have always held that Cæsarean section is not a justifiable operation in eclampsia, and I think still, as a general practice, that it is not. Now and then a case will occur where it will be indicated. That, however, will be a rare exception. Those who say that Cæsarean section is not to be performed in eclampsia argue that, first, strongly active treatment is not necessary in eclampsia; that the more or less expectant plan of eliminatives and all other medicinal measures will suffice to carry the patient along until delivery can be safely accomplished from below. They also argue that the abdominal and uterine incisions inflict an amount of trauma which will surely keep up the convulsions, and further, that the resulting peritonitis will tend to do the same, and the pain in the belly during the healing of the wound will prevent the woman from coughing and clearing the lungs of the œdema which frequently occurs in eclampsia; therefore it would directly increase the mortality. They argue, too, that Cæsarean section, *per se*, has its own mortality of six to eight per cent, and, under such circumstances, possibly eight to fifteen per cent.

In answer to the first argument — whether or not the waiting policy is the proper one in eclampsia — I believe statistics are proving that the waiting policy is not the best treatment; that is, as a routine treatment. It was in 1891, I think, that Dührssen first laid down the postulate, that as soon as a woman had a convulsion in eclampsia, he believed delivery should be effected. It is now fifteen years since that statement was made, and I think statistics prove that that is the better course to pursue. I may say that for many years I was brought under and influenced by the teachings of Jaggard, who advised a more expectant plan in these cases than that laid down by Dührssen; but my own results, and those of others I have watched, together with the statistics that have been published, have convinced me that a more active treatment is the better plan for eclampsia.

As regards another objection — the danger of the Cæsarean section, *per se* — that, to me, is a relative danger; it depends upon the ability of a man to operate and on the conditions of the case, and the circumstances and surroundings of the patient. I think, in the hands of a clean, careful man, who is a quick operator, that an abdominal Cæsarean section is not so very much more dangerous than vaginal Cæsarean section, or than the difficult, tearing, dilating, stretching operations necessary to deliver the baby from below.

As regards the objection that the patient cannot cough, because of the tenderness of the abdominal wall, that is one that does not have very much weight with me, because the woman is unconscious, anyway; she cannot feel much pain, and she does not cough very much, and when she is awake, even if she feel pain, she can clear her lungs by posture.

One important point in favor of Cæsarean section is that the child has a better chance of living than if the waiting policy is pursued. The statistics show, in cases of eclampsia treated by rapid delivery after the first convulsion, that the child has a much better chance of living than under the waiting policy. I feel, regarding the indication for Cæsarean section in eclampsia, exactly as I feel in regard to the indication for Cæsarean section in placenta prævia; namely, that, as a rule, we should not do it, but once in a while Cæsarean section offers the quickest, easiest, and safest solution of a formidable case.

Dr. C. G. Grulee presented the following pathological report of Dr. De Lee's case:

Report of Pathological Findings

Baby Y. Male, aged 5 days. Autopsy about eight hours after death. Weight 4 pounds 2 ounces (day of death); length 46 cm. Cord dry, but not detached.

Post-mortem. Rigidity present; lividity present over back, and marked on right side of head and chest. No external marks; skin icteric; anterior fontanel 3 x 2½ cm.; posterior fontanel open and parietal bones soft; all sutures open.

Chest. Breast-plate negative; pleural cavities contain no fluid; thymus, weight 44 grams; reaches as low as upper border of fourth rib on both sides, covering both auricles.

Microscopically. Corpuscles of Hassall present; gland normal in structure.

Lungs. Everywhere crepitant, but dark in color; hemorrhagic areas in the bases of both lungs, which, under the microscope, prove to be true hemorrhages into the tissue.

Heart. On the posterior surface of the left ventricle is a small white blister-like area, 0.75 x 0.5 cm., whose borders are continuous with the heart surface. On microscopical examination we find that on cross-section this seems to be made up of

several large sinuses lined with endothelium and lying between the heart muscle and the epicardium; the inner wall of the innermost of these sinuses either lies directly on the heart muscle or is separated from it by a thin layer of connective tissue; at the edge, the external covering is continuous with the epicardium of the ventricle; valves of the heart normal; foramen ovale and ductus arteriosus closed.

Abdominal Cavity. No fluid; bladder distended, reaching midway to umbilicus.

Liver. Dark red; markings distinct. Microscopically, there is seen a degeneration of the parenchyma of the hepatic cells. (Some question about this, because sections were not good.)

Gall-bladder. Bound by adhesion to the pyloric portion of the stomach, and the hepatic flexure of the colon; ducts patent; gall-bladder contained no bile, but a thick glairy mucus.

Stomach and Intestines. Negative.

Pancreas. Weight 2.2 grams. Digests starch, proteid, and fat.

Spleen. Rather dark in color; otherwise negative.

Left Kidney. Weight 7.8 grams. Fœtal lobulations. Uric acid infarcts.

Right Kidney. Weight 8.7 grams. Hemorrhages in capsule; otherwise same as left.

In neither kidney could I detect any macroscopical changes, other than the ones here given. Microscopically, both kidneys show a high degree of cloudy degeneration of the parenchyma of the cells, with loss of nuclei in places; those of the glomeruli probably being least and those of the convoluted tubules most affected. In no place could I detect any interstitial change.

Bladder. Distended; probably containing about 10 c.c. of urine. Urethra patent.

Urine. Contained a large amount of albumin, epithelial cells showing granular degeneration in large numbers, a few leucocytes and red blood-corpuscles (though I was able to obtain no test for hæmoglobin), and an occasional granular cast.

Brain. In opening the cranial cavity the membranes all over the convexity and base were seen to be acutely congested, and over the posterior parietal and anterior occipital lobes near and extending into the precuneate and cuneate lobes are small hemorrhages the size of a dime or larger.

Anatomical Diagnosis

1. Acute parenchymatous degeneration of the kidneys.
2. Hemorrhages into the meninges, lungs, and right perirenal tissue.
3. Acute parenchymatous degeneration of the liver. (?)
4. Lymphectasia of the vessels of the posterior wall of the left ventricle. (?)
5. Adhesion of the gall-bladder.
6. Prematurity.
7. Icterus.

In short, the lesions would seem to point to a severe intoxication, with special involvement of the kidneys and their function.

I wish to thank Dr. J. B. De Lee, whose patient the child was, and also Dr. A. J. Booker, the interne at the hospital, for his assistance.

DISCUSSION

DR. HELIODOR SCHILLER: The case of hæmatoma reported by Dr. De Lee deserves discussion. Cases of hemorrhagic diathesis in pregnancy are very rare, but they have been observed, and from time to time reported. There are cases reported of purpura hemorrhagica in pregnant women, where all of the symptoms have disappeared after the delivery of the child. We may suppose that toxins circulating in the blood of the pregnant are the ætiology of the hemorrhagic diathesis. The similarity of the affection of the gums of the patient with scurvy does not justify the diagnosis scurvy. The fact that the gums healed quickly after delivery speaks against scurvy. The patient had albumin and blood in the urine, and we shall not make a mistake if we suppose that the hæmatoma was produced by the existing hemorrhagic diathesis.

REPORT OF CASE OF ACUTE INVERSION OF THE UTERUS RETURNED BY TAXIS

DR. RUDOLPH W. HOLMES: I am indebted to Dr. N. M. Percy for the privilege of seeing and reporting this case.

Mrs. K., aged 27, primipara, born of Scandinavian parents. She has had the usual infectious diseases of childhood. Menstruation began at 14, and has been always regular and painless. Married when 25 years of age. Last menstruation was about September 15, 1905, and labor was due June 22, 1906. Two weeks before the calculated time, contractions began; i. e., June 7th. At the end of about ten hours of easy labor, the os was fully dilated. After waiting two hours in the second stage, with no progress, forceps were applied at 11 A. M., June 8th, and the head brought to the perineum, when the instruments were removed. Shortly thereafter the fœtal heart tones became weak, so the head was expelled by Kristellar expression. The baby weighed four and a half pounds. The cord was three times about the neck. The uterus was massaged for fifteen or

twenty minutes, when, on account of hemorrhage, the placenta was delivered by a combined Credé and traction on the cord. This maneuver expelled the placenta with the fundus. The inversion was complete; the placenta was peeled off quickly, and the uterus supposedly replaced. Hemorrhage ceased, recurring at the end of an hour and a half. Thereupon the vagina was tamponed. The tampon was removed the following day. No further bleeding occurred, although some large clots were expelled.

For twenty-four hours the woman hovered between life and death, the skin cold and clammy, the pulse hardly perceptible. Reaction then set in. On the fourth day the temperature was 104°, and the pulse 140. At this time an obstetrician saw the patient, and advised intrauterine douches of bichloride of mercury, 1-4000, followed by sterile water. Under this medication the patient ran a mild sepsis, the pulse oscillating between 100 and 130, and the temperature 99° to 102.8° for about twenty-five days. The douche was given with the vagina distended by specula. The physician who gave the douche considered the blood-covered endometrium to be the vaginal mucous membrane. Mercurialism appeared on the tenth day; so the douches were discontinued. At that time Dr. Percy was called, and the woman was sent to the hospital. The next day Dr. Percy invited me to see the patient, and I was able to corroborate his diagnosis of complete inversion.

Under anæsthesia, the ring of cervix was palpable above the pubes; the ora Fallopii were distinctly visible; as was, also, the placental site, which was fundal. The uterus was remarkably well involuted for the eleventh day, and especially so for a uterus suffering the effects of a puerperal sepsis. At Dr. Percy's request, I endeavored to return the uterus by taxis. After some persistent endeavor, covering perhaps ten minutes, it seemed useless to try reduction further, when, suddenly, the uterus slipped from my fingers and returned to its normal relations. At once the uterine cavity was tightly packed with gauze wrung out of a formalin solution. On July 2d the patient went home well. An examination a month later showed a uterus normal in size, position, and mobility.

Certain reflections may be made in the consideration of this case, which may be guides for conduct in labors, and for the treatment of like conditions when they occur, which, fortunately, is extremely rarely. The first thing I would state is, that nearly half of the cases of inversion, such as the one I present to-night, are produced by Credés applied on an atonic uterus, or, perhaps, when the fundus is not grasped in the hand, but the hand merely pushes on the fundus. The other manipulation, which vies with the wrongly applied Credé in producing inversion, is the barbaric traction on the cord. I would express my firm conviction that it makes no difference whether there be bleeding or not, every uterus which has been inverted and corrected, whether corrected primarily or after a lapse of time, should have a firm intrauterine tamponade, and then ergot administered in full doses. Correction alone is not enough. A point in the technique of returning an inverted uterus is worthy of mention. That part of the uterus which comes down last, i. e., the cervix, should be returned first, and the fundus should be returned last. In other words, the return of the inverted uterus should be in the inverse order to its production. Sometimes it is difficult to return the uterus in the midline, on account of the promontory. In such cases, success may follow if the direction of taxis be towards the iliosacral cavity. The uterus in the mechanism of inversion and correction is a capricious thing. We may not always know the true mechanism in individual cases. For example, White of England, I believe it was, made prolonged attempts at taxis, with no avail; so he determined to remove the uterus the next day. When he came to examine at the time of operation, he found that a spontaneous return had occurred in the night.

OBSERVATIONS ON THE OPERATIVE TREATMENT OF PROLAPSE OF THE UTERUS

Dr. Franklin H. Martin read a paper with this title. (See paper, *ante*, p. 164.)

DISCUSSION

Dr. E. C. Dudley opened the discussion. He said:

I shall confine my remarks to complete descent of the uterus. It is most important to remember that prolapse of the uterus is only an incident to prolapse of the pelvic floor. The whole mechanism is that of hernia; the condition is hernia, for the extruded hernial mass, of which the center is the uterus, drags after it a peritoneal sac, which, hernia-like, contains small intestine. This sac forces its way to the pelvic outlet and extrudes through the vulva, having the inverted vagina for a covering. For the surgical relief of this condition, numerous operations, following one another along from the period of James Y. Simpson, Baker Brown, Marion Sims, and Thomas Addis Emmet to the present time, have received in greater or lesser degree the sanction of experience. These operations, for the most part, may be classified under two heads. One class has for its object simply the narrowing of the vagina

in order to hold the uterus somewhere in the pelvis above the constriction, regardless of the position of the organ. Operations of this class may correct the mal-location, not the malposition. Usually, they consist of the removal of an elliptical piece or superficial denudation from the anterior or posterior wall of the vagina, or from both, and in the closure of the exposed surfaces by means of sutures; for example, in the Stoltz operation, the purse-string suture. No effort is made to restore the normal axes of the uterus and vagina. The whole purpose is to make the vagina so narrow that the uterus cannot pass through it. Such operations generally fail, because they leave the uterus and vagina alike in the same vertical axis. The restricted vagina therefore cannot resist the downward force of the uterus, which must invariably dilate the vagina a second time, and force its way through, with reproduction of the hernia. Many of these operations, notably that of Stoltz, do permanent harm, because they shorten the vagina, and thereby make it draw the cervix uteri away from the sacrum toward the pubes, so that the body of the uterus may have space to fall backward to the permanent malposition of retroversion. We may, perhaps, without further discussion, throw out all operations belonging to this group.

An efficient operation on the vaginal walls should have for its object, not narrowing the vagina, but restoring the normal direction of it, as well as the normal direction of the uterus, with a twofold purpose, so that, first, the upper extremity of the vagina, together with the cervix uteri, should resume its normal location within about an inch of the second and third sacral vertebræ, just where the uterosacral supports would tend to hold them if their normal tonicity and integrity could be restored, and so that, second, the lower extremity of the vagina shall be brought forward against the pubes. The fulfillment of these two indications will restore the normal obliquity of the vagina, and will hold the cervix uteri so far back toward the sacrum that the corpus uteri must be directed forward in its normal anterior position of mobile equilibrium. With these conditions secured, the uterus, being at an acute angle with the vagina, and having little space posteriorly, cannot retrovert and turn the necessary corner which would permit it to prolapse in the direction of the vaginal outlet. In order to accomplish this, two things hitherto have been regarded as necessary: 1. Excision of the cystocele, and such an operation of colporrhaphy as will force the upper extremity to the vagina, and together with it the cervix uteri, back to the normal location in the hollow of the sacrum. 2. An adequate posterior colporrhaphy, that is, less comprehensively speaking, an adequate perineorrhaphy.

Excision of the Cystocele. Plastic operations performed on the anterior and lateral walls of the vagina from the beginning down to the present time frequently have consisted in superficial denudation and reefing or puckering in with sutures the anterior or lateral walls of the vagina, and have been only partially successful, first, because efficiency requires deeper work than superficial denudation can accomplish. Complete prolapse, being hernia, should be treated according to the established principles of herniotomy; that is, excision of the sac in such a way as to give strong fascial surfaces to be firmly united by sutures. The absurdity of treating any other hernia by superficial denudation and reefing and tucking in and suturing the surfaces together must be apparent to any one. *Operations of the second class*, by means of which the cervix is forced towards the sacrum, although correct in principle, unfortunately do not always produce the desired permanent result. In too large a proportion of cases there have been, in my own experience at least, partial failures. I do not mean that the application of these principles has resulted in discouraging failure. I do mean that the results of the operation which I published two or three years ago, in which there was an effort fo utilize the supporting power of the broad ligaments have not been quite satisfactory.

On account of occasional failures, and for the purpose of doing such an operation as would result beyond peradventure in a successful result, I became disposed more and more to substitute for plastic surgery the operation of complete vaginal hysterectomy, and this fact leads up to the gist of the whole matter.

Just at this point it is important to observe that complete descent involves not only the uterus, but, as well, the whole pelvic floor, including the rectum, vagina, and bladder, and that the removal of the uterus, therefore, while it disposes of that organ, does not necessarily overcome the remaining part of the hernial descent; that is, the rectum, vagina, and bladder may still protrude through the vulva. In the operation of hysterectomy for the relief of this condition, therefore, it is necessary not only to remove the uterus, but to unite the broad ligaments by end-to-end approximation, bringing them together in direct contact with the wound made by the removal of the uterus, so that the ends of these broad ligaments shall be united, both to one another and to the upper extremity of the vagina. In extreme cases it is not even sufficient to unite them end for end. They may have to be folded upon themselves. At any rate, fixation of the

severed ends of the broad ligaments to the vaginal wound must be regarded as a *sine qua non* in the surgical treatment of complete procidentia by hysterectomy.

Now comes the substance of all I have to say on the subject. If the essential factor in hysterectomy for complete descent of the uterus lies in fixation of the broad ligaments to the vaginal wound, the question naturally presents itself, Why should not the same result be aimed at by similar utilization of the broad ligaments without removal of the uterus? Such an operation I have undertaken successfully a number of times since last January. The article describing this operation, with abundant illustrations, is now in press, and will appear next month in the *Journal of the American Medical Association*. The operation, briefly, is as follows:

First Step. Separate the bladder from the uterus, clear to the region of the vesico uterine reflection of the peritoneum, and in extreme cases I would carry the separation even into the peritoneal cavity. This step of the operation is precisely the same as what would be required in ordinary anterior vaginal section into the peritoneal cavity, except that it is not usually necessary to invade that cavity.

Second Step. Divide the anterior vaginal wall by a median longitudinal incision from the region of the urethra to the region of the cervix uteri, and strip off and remove the redundant cystocele portion of the vaginal plate of the vesicovaginal septum and push the bladder up in place on a level with the uterus, out of the way of the operator.

Third Step. The anterior wall of the uterus and the anterior surfaces of the broad ligaments having been exposed in the first step of the operation, the lower two thirds, or even more, of each broad ligament is severed from the side of the uterus without entering the peritoneal cavity. This cutting away of the broad ligaments should be performed in such a way as to remove with it a thin layer of the lateral wall of the uterus on each side; that is, the incision which frees the lower two thirds of the broad ligaments from the uterus should be made inside the utero-ovarian anastomosis in order to avoid troublesome hemorrhage. These ligaments, having been freed, are now brought together and stitched end for end directly in front of the uterus in such a way that they will hold the cervix uteri back in the hollow of the sacrum, as it were, into sling. The corpus then should fall forward into a normal anteversion. The vaginal wound is then closed by means of interrupted sutures, just as it would be in the ordinary operation of anterior electrorrhaphy.

It goes without saying, that an adequate operation on the posterior wall of the vagina — that is, posterior colporrhaphy or perineorrhaphy — performed in such a way as to bring the low extreme of the vagina forward to the pubes, is essential to a successful result. Should the abdomen be opened for any purpose, shortening of the uterosacral and round ligaments also might be indicated. So far, however, I have not found these two operations necessary in my own cases.

DR. T. J. WATKINS: There is one point in the development of the operation that Dr. Martin did not mention, and that is, Wertheim's modification of Freund's operation, which consisted in delivering the uterus into the vaginal canal through an incision in the anterior vaginal fornix. He then made a denudation upon the anterior and posterior walls of the uterus and sutured these denudations to the respective uterine walls.

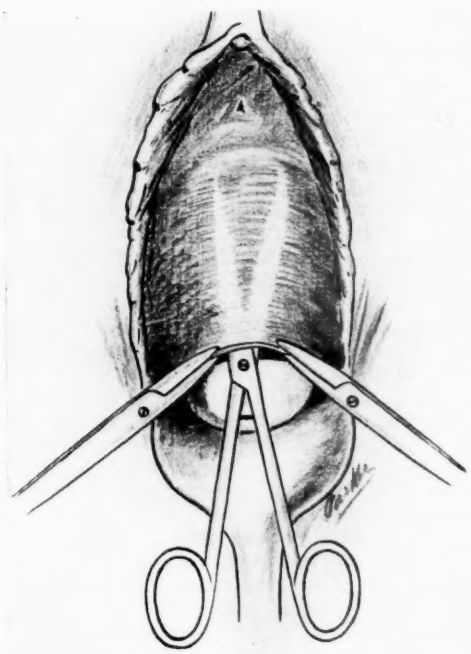
The operation which I have described was presented to the Chicago Gynecological Society, September 15, 1899, and was published in the *American Gynecological and Obstetrical Journal*, November, 1899, and was again published and illustrated last winter in *St. Luke's Hospital Report*, 1905, and also in SURGERY, GYNECOLOGY AND OBSTETRICS in June, 1906. I may say two or three things about the principle of my operation: 1. The worst cases occur after the menopause. 2. After the menopause the bladder is the only organ that has any special function, and consequently it is the bladder that gives most of the trouble in cases of prolapse after the menopause. In all operations of suspension, one has to guard against making a line of union that will be subjected to much tension. If the line of union is subjected to much tension, it is certain to stretch out, it being a physiological principle that all connective tissue stretches when it is subjected for some time to tension.

The operation that I have described is something like this: If you imagine this (indicating) to be the bladder, the fundus uteri is brought underneath the bladder at this point (illustrating), and then the line of union takes place between the bladder and posterior wall of the uterus. The line of union is so placed that it is not subjected to tension, or if it is subjected to tension, the surfaces simply pull on each other, and the traction thus exerted causes very little tendency to elongate.

The object in leaving the uterus, instead of removing it, is to give a firm support to the bladder, which was mentioned as the organ that is chiefly affected in the very bad cases. The uterus, when it is tipped forward here (indicating), gives an ideal support to the bladder. In fact, the bladder rides upon the posterior wall of the uterus, and any

tendency of the uterus to prolapse elevates the bladder, and any tendency of the bladder to prolapse tilts the uterus farther forward, so that the prolapse of the two organs becomes antagonistic.

Now, in the operations which have been designated for supporting the bladder with the removal of the uterus, it has been extremely difficult to bring the support sufficiently near the pubes; in fact, it would seem practically impossible to support the bladder sufficiently far forward to prevent its prolapsing without making an extensive denudation of the anterior vaginal wall underneath the rami of the pubes, so that the broad ligaments can be brought together close underneath the pubes; that is, it is thus extremely difficult to obliterate the hernial opening between the broad ligaments and the anterior bony wall of the pelvis. This operation which I have described was first done in 1898. It was presented before this Society and published in 1899, the same year that Wertheim published his modification of Freund's operation (*Centralblatt für Gynäkologie*, No. 14, 1899), and three years before Bucura (*Zeitschrift für Geburtshülfe*, 1901) published Wertheim's results of his modification of Fritsch's modification of Freund's operation.



Method of denudation of cystocele with scissors, as described by Dr. Watkins.

The operation which Dr. Dudley has described was described by me in *St. Luke's Year-book* for 1905, and also in my article in SURGERY, GYNECOLOGY AND OBSTETRICS, June, 1906, and is one of the modifications which were given for the treatment of cases operated upon before the menopause.

I beg leave to quote from those papers: "This modification is made by severing a portion of the base of each broad ligament from the cervix and by suture of the free ends of the broad ligaments together in front of the cervix. The remainder of the operation is the same as described above."

"If it is inadvisable to render the patient sterile, the operation may be modified by leaving the body of the uterus free in the abdominal cavity, and by suture of the anterior vaginal wall to the round ligaments and to the lower surface of the uterine body. In exceptional cases the base of each broad ligament may be severed and united in front of the cervix as described above." I have recently modified the denudation, which makes it more easily performed, and there is very little loss of blood. First, a short incision is made in front of the cervix, severing the anterior vaginal wall from the cervix; then the vaginal wall is caught on either side to keep it tense, and the scissors are pushed underneath the mucous membrane and carried up as far as one desires, to separate the bladder from the vagina, and then by opening the scissors one denudes the entire area. In that way one can denude a large cystocele in one or two minutes.

As regards the results, the first operation I did of this kind was in 1898, and, so far as I know, there has only been one failure, and that came under my observation this morning. The prolapse had recurred, but an examination of the patient showed that the line of union had not been affected. The uterus was still underneath the bladder. The bladder had not perceptibly prolapsed, but the entire fundus had protruded through the vaginal orifice, leaving the cervix high up near the sacrum. That resulted possibly from some suppuration of the perineal wound. That patient had had hemorrhoids. These were operated on, the perineum became infected, and the result of the perineorrhaphy was not good. I am inclined to think that if the perineum had healed well, this recurrence would not have taken place.

DR. DUDLEY was not present at the meeting, but sends the following reply, in writing, to the claim of priority made by Dr. Watkins:

This claim of Dr. Watkins is substantially the same as the one made by him in a personal letter to me, which I published in the *Journal of the American Medical Association*, December 22, 1906, together with my re-

ply, which is published in the same number of that journal. This reply I herewith again submit.

"In order to show that I have called no other man's work my own, and for the information of those, if such there be, who perchance may be interested, I take pleasure in making the following statement:

"The transactions of St. Luke's Hospital for 1905 were published, not early in the year, as alleged, but about April 8, 1906. SURGERY, GYNECOLOGY AND OBSTETRICS for June, 1906, was published June 19th. I find, on consulting these two publications, that they contain an article by Dr. Watkins descriptive of an operation for descent of the uterus and cystocele, which operation is entirely different from that described by myself. I find, also, that there is wedged into a paragraph, where any one without careful reading might overlook it, a short statement of three or four lines, to the effect that in exceptional cases the base of each broad ligament may be severed from the sides of the uterus and united in front of the cervix. This procedure, which embodies the essential principle of the operation for descent described by myself, obviously was introduced in the paper of Dr. Watkins as an incidental suggestion only. It was not included even among the illustrations of this otherwise profusely illustrated paper. The suggestion, however, although appearing in such form, furnishes, so far as it goes, valid ground on which may be based a clear title to priority of publication. But, after this has been said, it is proper to take into account the following significant facts:

"1. I discussed the illustrations for the procedure in question with the artist who made the drawings, Mr. J. K. Parker, in November, and gave him the preliminary sketches early in December, 1905. Moreover, I freely discussed the method as early as December, 1905, and frequently thereafter, with internes and assistants at St. Luke's Hospital, and with numerous other professional friends, so that months before any publication by either of us the fact of my having in preparation a paper on this method was known to many people.

"2. In February, 1906, two months before the first publication by Dr. Watkins, I gave my article to *The Journal of the American Medical Association* for immediate publication, but, on request, withheld it temporarily from publication, in order that it might be read at the June session in Boston, and might thereby become part of the transactions. The paper, accordingly, was read and illustrated with lantern slides on the 6th of June, 1906, precisely thirteen days before the appearance of the June number of SURGERY, GYNECOLOGY AND OBSTETRICS."

DR. JOSEPH B. DE LEE: Perhaps a word from the obstetrician may not be out of place in discussing the question of prolapse, in that perhaps the majority of prolapses are produced, or at least the beginnings are made, in obstetric cases. The frequency of prolapse after complete laceration of the perineum is less than we should expect, even though the larger part of the pelvic floor has been destroyed. The idea that a prolapse is to be cured by the shortening and strengthening of the lateral supports in the broad ligaments and uterosacral ligaments should have occurred much sooner to the gynecologists, and would have occurred if they had studied the method or manner in which a prolapse is begun. When an operative delivery is made through a cervix that has not been effaced and drawn up into the body of the uterus, or when the woman is bidden to exert herself and is made to bear down with powerful expulsive efforts before the cervix is dilated and withdrawn above the baby's head, a great deal of traction is put upon the broad and sacrouterine ligaments, which results later, perhaps, in the tearing of the fibers, and certainly in overstretching. In my opinion, that is a cause, or at least the beginning, of a great many cases of prolapse. It would follow, therefore, that shortening or strengthening of these ligaments would be the method of cure.

DR. ALBERT GOLDSPOHN: It is proper to mention that we should be careful to exclude an elongated cervix, which by some might be called a prolapse, from an actual prolapse of the uterus. Probably that is generally understood, but it should be mentioned that the operations that have been described are suitable for cases of actual prolapse of the uterus, and not for cases of elongation of the cervix, in which the fundus remains at approximately its normal level.

The whole subject of treatment of prolapse of the uterus in this country does not present great obstacles, because the patients whom we get with actual prolapse of this organ are mostly advanced in years, and they are either beyond the childbearing period, or they are quite willing to be so; consequently, what remaining capacity they have in that direction is very little, and it makes the class of operations that have been alluded to rational and anatomically correct. It is true, the pelvic floor should not be regarded as the bearing structure of the uterus. It is not intended to be such. It does not properly come in contact with the uterus in a normal condition of things, except during straining efforts, as at defecation or any violent exercise of the diaphragm, and intra-abdominal pressure. Then the uterus descends to the pelvic floor, and it is then very necessary that its excessive descent should be positively arrested by an intact pelvic floor. The lacerated perineum becomes a harmful factor at this moment, because if the effect of intra-abdominal pressure is not checked by a potent pelvic diaphragm, the uterine supports are overdistended and cannot recoup themselves. It is quite important, in considering the treatment of prolapse of the uterus, to keep in mind the chief mechanical ætiological factors. Dr. De Lee has mentioned an important one; but

aside from that, what are the things that probably induce an elongated cervix or an actual prolapse of the uterus mostly? The bladder exercises a chief influence by being the entering wedge which, by extension downward upon the anterior vaginal wall, causes the latter to pull downward upon the uterus and to invite either an elongated cervix or an actual descensus uteri. A defective pelvic floor or rectovaginal septum permits the forward encroachment of the rectum upon the vaginal space, and then we have the same traction downward upon the cervix by the posterior vaginal wall, which produces either an elongation of the cervix or a descent of the uterus. For that reason, the pelvic floor proper, the levator ani muscle, together with the layers of pelvic fascia between which this muscle is placed, are very important factors to be in their normal position, and that that part of the union of the two lateral descending portions of the levator ani which normally exists anteriorly to the rectum be not destroyed.

We have a real deficiency of means or methods for the cure of prolapse of the uterus in younger women who are still to bear children, but not for that in elderly women, who are not supposed to conceive. While it is well enough that we improve our technique, yet we have been able to produce good results in these sterile cases, without attacking the broad ligaments and the sacrouterine ligaments, by placing the disturbing factor, the bladder, away from the anterior aspect of the uterus, upon the top of the fundus and fastening the latter well up upon the anterior vaginal wall, and then also making a good restoration of the pelvic floor. Such a procedure will give permanent results that, in old women, will not permit of any return; that is, if we do the right thing in restoring the pelvic floor. But it depends on that, whether we simply operate upon the vagina or things on the surface, or whether we also restore the bearings beneath; i. e., the levator ani actually.

Of all the operations that have been mentioned this evening, not one of them permits a woman to become pregnant again, unless it be the one suggested by Dr. Dudley. I can see how there would be an advantage, in some cases of prolapse of the uterus, in doing what Dr. Martin has done, because it enables thorough union of the broad ligaments to each other to take place. They can be reefed up so as to raise the cervix as high as one desires, and this gives opportunity to shorten the uterosacral ligaments, upon which we depend to hold the cervix back in the hollow of the sacrum.

Dr. Gustav Kolischer: I should like to speak on one or two points without much detail. In discussing operations for prolapse of the uterus, it seems to me that all of the speakers take for granted many things which they cannot prove. We do not know whether the ligaments hold the uterus in position or not. All we know is, that certain ligaments conduct arteries and nerves to the organ, and conduct veins and lymphatic vessels from the organ to the parietal parts. I do not think we have any proof that the ligaments hold the uterus in place, and all that has been said and written in regard to that theory is supposition. We know just as little about the support of the pelvic floor in keeping the uterus and bladder in place. A complete prolapse of the uterus has been found in infants in which the pelvic floor was not injured in any way. Recently, Schatz Sutter read a paper in which he claimed that prolapse of the uterus is nothing more nor less than a hernia occurring from a hiatus formed by the branches of the levator ani, the pelvic fascia giving way, thus affording an opportunity for the uterus to descend. If that is true, Freund's operation should be a success, for the passage of silver wire into the vaginal wall will hold the uterus in place. It is possible that by altering the ligaments or by shortening them we can keep the organ in place for a certain time, but no one can say that an operation on the ligaments will keep the uterus in place. How is he going to prove that? We are able to keep the uterus in place by sewing it to the anterior vaginal wall. Do we shorten the broad ligaments so as to give support to the uterus? Certainly not.

Another point in this discussion is this: Arguing on the theory that the broad ligaments support the uterus (which is uncertain), if the uterus prolapses the broad ligaments must give way. Why should they not give way again if we pull them together in front of the uterus? We can only say that we succeed by certain operations in keeping the uterus in place for a reasonable length of time. The only method of operating which may be considered a complete success is that which attaches the uterus in some way to the anterior vaginal wall. Pulling the cervix backwards is no guaranty that the uterus will not subsequently prolapse. That is proven by the cases where an anteverted or anteflexed uterus may at the same time be prolapsed. Where a uterus is anteverted the cervix falls backwards. The position of the cervix has nothing to do with keeping the uterus in position. If we start out on certain premises, as, for instance, that the pelvic floor is not a support of the uterus, we can make all kinds of fallacious conclusions. The pelvic floor does not keep the uterus in place, and injury to the pelvic floor does not of necessity cause prolapse of the uterus, because we have prolapse of this organ in young virgins in whom the pelvic

floor has not been injured. The same holds good in our attempts to explain a prolapse of the uterus because the pelvic floor is injured. We do not know anything about the so-called equilibrium inside the abdominal wall. All we know is one thing; that is, we have to look at the contents of the abdomen as a semisolid mass, or a semiliquid mass, and, according to the teachings of physicists, this semiliquid, under pressure, will act in a vertical or absolutely straight direction against all the walls of the cavity that contains these organs. These organs are kept in place by what we may call the equilibrium of the pelvic organs. We do not know, again, that the ligaments hold any organ in the human body in place.

DR. ALBERT GOLDSPOHN: Dr. Kolischer speaks of instances of prolapse of the uterus when the uterus is thoroughly anteverted. Such instances are so rare that they cannot be used for argument. As a rule, when the uterus descends it will be in retroversion, and a uterus that is in anteversion will never practically be found prolapsed. There are cases in which the pelvis is so roomy that a very small uterus makes very little difference which way it turns.

The general proposition stands, that the uterus must first be retroverted before it descends, and retroversion is really the first step in descensus. The positive statement that the ligaments have nothing to do with the support of the uterus, I will simply say, is erroneous. While we do not know what factors chiefly determine the inclination of the long uterine axis in an anteroposterior direction, we do know that the broad ligaments have something to do with holding the uterus in a certain plane in the body. The causes of the inclination of the long uterine axis anteriorly or posteriorly are somewhat uncertain. It is quite doubtful whether the round ligaments and sacrouterine ligaments have much to do with that; but that the broad ligaments have something to do with holding the uterus normally, in the absence of straining efforts, from dropping down on the pelvic floor is practically a settled anatomical fact.

DR. GUSTAV KOLISCHER: I should like to have Dr. Goldspohn furnish the proofs of his statement that the uterus is kept in position by the broad ligaments; that the uterus cannot touch the pelvic floor because anatomically the broad ligaments prevent it from so doing.

DR. GOLDSPOHN: Because there is nothing else that can keep the uterus off the pelvic floor.

DR. KOLISCHER: You know that; I don't.

DR. T. J. WATKINS: The operation I have described is intended only in the unmodified form for the treatment of cases after the menopause.

To recapitulate as to the priority of the operation:

Freund did his operation in 1895.

Fritsch later modified Freund's operation.

Watkins did his operation in 1898.

Wertheim published his modification of Fritsch's modification of Freund's operation in 1899.

Bucura (Wertheim's assistant) reported the results upon that operation in 1901.

It is improbable that Wertheim did the operation which I published in 1899, before Bucura made his report; namely, in 1901.

PYELONEPHRITIS OF PREGNANCY

DR. CHARLES B. REED read a paper with this title. (See paper, *ante*, p. 196.)

DISCUSSION

DR. CHARLES S. BACON: I think it would be well in these cases, as well as in some others, in speaking of the many pathological conditions occurring in pregnancy, to distinguish between the pyelonephritis of pregnancy and the pyelonephritis in pregnancy. I think the latter condition is quite common, and is made worse by the presence of the pregnancy — a chronic condition, I mean, that is rendered more serious by the presence of the pregnancy.

The hypothesis given by the writer as to the ætiology does not make quite as prominent as it should the question of infection, or rather the source or sources of the infection. I believe that is dismissed in the paper by the statement that probably it is generally from the bladder. That, I think, is contrary to the ordinary belief, and probably contrary to the facts. Infection from the intestines is very probable, because it occurs in other conditions. Just as we have infection of tumors of various kinds from the intestines in cases of constipation, fæcal impaction, etc., we are led to think that would probably occur here, and might also be an ætiological factor. The presence of substances in the ascending or transverse colon, leading to injuries to the mucous membrane of the intestine, would favor the transmission of the infecting germ, and that can be taken as an important ætiological factor.

The hypothesis of the toxins of pregnancy, so far as I know, is not based upon the pathological findings, aside from the general finding of a certain amount of albuminuria. The statement that these cases occur when the organisms are in greatest abundance, I do not understand. I do not know when the toxins of pregnancy are in greatest abundance. There is considerable reason for believing that these are introduced earlier in pregnancy, rather than later. Later, there may be relative immunization.

I bring up these things to elicit a little more discussion from the other fellows.

As to the management of these cases, there is not much to be said with regard to treatment, other than that mentioned by the writer, except the question of position of the patient. The old rule was based upon the theory that there is a certain amount of compression of the ureters, and therefore it is reasonable to have the patient lie on the opposite side of the diseased kidney. I have found the rule a good one, even if the reason for it is not correct.

Dr. Joseph B. De Lee: Regarding compression of the ureter. If there is any department in obstetrics that is cloudy, it is the physics of the abdomen, and while there have been many attempts made to solve the problems offered, nothing is positively known. It used to be thought that the condition under discussion was due to compression of the ureters by the pregnant uterus, and that the uterus also compressed the veins as they enter the pelvis from the extremities, and also that compression of the bladder during pregnancy occurred, but it is hard to understand how compression sufficient to produce symptoms could be made during pregnancy by the organs in the abdomen. The specific gravity of the uterus with its contents is very little greater than the specific gravity of the intestines, and the compression exerted by the intestines on the pelvic veins produces no stasis in the veins nor pressure on the bladder. The theory that compression of the ureters causes pyelitis and ureteritis does not appeal to me. It strikes me, it is more likely one of the results of general infection, or transmitted from a neighboring organ; e. g., the appendix.

In the past year I have had six cases of infection along the urinary tract. We could determine it more or less definitely to be at some point in the urinary tract. In one case the symptoms were those of sepsis, in which we could hardly localize the sepsis until finally the urine showed albumin and the streptococcus and the bacterium coli. Cystoscopic examination of the bladder showed a cloudy œdematous mucosa, in which the outlines of the blood-vessels were lost, and we diagnosed swelling of the mucosa due to infection. It might have been due to pregnancy, but there were no other œdemata in the neighborhood.

Another case presented all the evidences of pyelitis and ureteritis, and the ureter could be felt at the base of the bladder, on the right side particularly, and to a less extent on the left side. There was pain running up the ureter, with a small amount of albumin, a small number of casts, and a small number of mononuclear cells, and occasionally whites. Under cystoscopic examination, the mouth of the ureter was seen to be distinctly reddened and swollen.

I believe the paper is very timely, in drawing our attention to the frequency of infections along the urinary tract.

One thing that may be in line with what Dr. Bacon has said is this: the possibility of a stone in the ureter being the cause of a great many cases of pyeloureteritis. I think pyeloureteritis is more common than pyelonephritis, because in my cases there were no evidences of involvement of the kidney, and careful examination disclosed only a few casts and kidney epithelium, particularly the casts. Of nine cases I have had in which I diagnosed infection of the urinary tract, in none was the kidney involved, wherefore I would rather speak of it as pyeloureteritis and cystitis. In my first case there were symptoms of sepsis, followed by the discovery of bacteria in the urine. That woman developed cystitis later, so that it was a descending infection.

One other point. Before one thinks of interrupting pregnancy for ureteritis and pyelitis, it might be wise to catheterize the ureters to see if a stone is or is not present in the ureter. In this connection I wish to cite briefly a case that was seen in consultation. The woman presented symptoms of ureteropyelitis. One consultant recommended cystoscopy and ureteral catheterization; another consultant, without much consideration of the case, ordered the removal of the fœtus, which was done. The child died in a few hours. Later, the woman expelled a small stone from the right ureter into the bladder and out. That stone, if the ureter had been catheterized, might have been washed out, and thus the child's life saved.

I would ask the President to call on Dr. Kolischer, who has had a large experience in these urinary tract infections.

Dr. Heliodor Schiller: If I understood a part of Dr. Reed's paper, he advanced the theory that toxins circulating in the blood produce a primary lesion of the epithelium, and in this way open other avenues of infection. If that is the case, how can we explain cases of unilateral pyelonephritis and the prevalence of the affection of the right kidney, which is observed in a great majority of these cases, the supposed toxins not being of corpuscular nature?

Dr. Gustav Kolischer: Dr. Reed's paper has touched on a very important topic, about which very little that is definite is known, so far.

I would indorse his statement about the effect of compression of the ureters. In the early part of 1890, after improvements had been made in the technique of urethroscopy and ureteral catheteriza-

tion, it was important to decide whether compression of the ureters was as frequent as was thought. True enough, once in a while we found, post-mortem, that the ureters were compressed. Among a few hundred cases of pregnant women that were examined and catheterized after pregnancy, we found two cases in which the right ureter was compressed, so that it was impossible to pass the ureteral catheter beyond a certain height. That disposes of the theory that, at least in the majority of cases, compression of the ureters is the cause of the development of pyelitis. We have to include one thing; that is, the increased susceptibility of the organs during pregnancy to infection. Dr. Frankenthal was the first to point out that the kidney is very susceptible to infection during pregnancy. He was the first man to call our attention to nephritis in pregnancy during attacks of appendicitis and acute tonsilitis. That pyelitis during pregnancy might occasionally cause very serious disturbances is an established fact. I saw, for instance, among other cases, two cases of pregnancy at about the eighth month in the practice of Dr. Frankenthal, in which there was pus in the urine, and sensitiveness on one side (the right side in both). Cystoscopy in one case revealed absolutely a normal bladder, the urine passing out of the right ureter, but not out of the left, and inasmuch as the condition of the patient was bad, and she had chills every three or four hours, with high temperature, it was decided to make a nephrotomy, which was done successfully, and the woman went to full term. Later, the kidney fistula closed, and the patient recovered.

The other case shows interesting sequelæ. This patient was delivered after the fistula closed. Later on, she developed symptoms of cystitis. She had frequent urination, pain, her bladder felt heavy and painful, and she had pain during and after urination. For about two years there was not much done for the patient. She refused interference. By means of the cystoscope I found two ulcers in the bladder, situated at the trigone. After the ulcers were curetted and the bladder catheterized, healing took place inside of a week.

We know that a normal bladder can be flooded with pus that comes from the kidney for a long time without becoming infected. Evidently, pregnancy does predispose to bladder infection. That is proven by some observations I made years ago, at which time I reported a number of cases, including among them the case of a woman who, being habitually constipated, developed, while pregnant, cholecystitis. The colon bacillus appeared in pure cultures in urine and in pus.

So far as therapy is concerned, in extreme cases, where there is a combination of conditions, nephrotomy is the operation of choice. Certainly, we should resort to it before we think of interrupting pregnancy. There are cases on record, reported by men of considerable experience, in which it is pointed out that it is possible to relieve these patients, to a certain extent, of the clinical symptoms of pyelitis by renal lavage. Of course, if we do not succeed in a few sittings, we should resort to nephrotomy.

The ætiology is obscure. While we can exclude compression of the ureters in the great majority of cases as a cause, nevertheless, in pyelitis or in pyelonephritis in pregnancy, as a rule there is only one kidney involved, and that is the right one. I cannot offer any explanation for that, but the fact remains.

Tenesmus and frequent urination appear during pregnancy; but they should not always be attributed to disease of the kidney. As a rule, those symptoms come from irritability of the bladder. We see excessive irritability of the bladder, too, in cases where there is no disease of the kidney. If we have a stone in the kidney, in the parenchyma, or in the pelvis, the stone or stones becoming movable, creating symptoms of pyelitis, irritability sets in immediately. Any irritability during pregnancy should make it imperative for us to search for some disease in the kidney.

As to the diagnosis of ureteritis, this should be carefully made, because, as was first shown by Sänger, the ureters can be palpated in any pregnant woman. A few weeks after pregnancy begins, we can find only a part of the ureter. The diagnosis of ureteritis is more or less guesswork. The diagnosis of ureteritis can only be made when the touch of the ureteral catheter is perceived by the patient as a severe pain. The ureter, as a rule, is absolutely insensitive to the ureteral catheter; but in cases of ureteritis the sensitiveness of the ureter is excessive. So we can make a diagnosis of ureteritis only when we find this sensitiveness to the touch of the catheter.

DR. REED (closing the discussion): As to Dr. Bacon's desire to emphasize the distinction beween pyelonephritis in pregnancy and pyelonephritis of pregnancy, I should have stated that the title of my paper was "Pyelonephritis *of* Pregnancy," so that confusion with pyelonephritis which occurs outside of pregnancy, and which should not be regarded as a gestational complication, might not arise.

In regard to systemic infection, or rather what is termed hæmatogenous infection, there pertains an importance not to be entirely denied, but it was passed over rather cursorily in the paper with deliberate intent, because I desired to emphasize par-

ticularly the vesical origin of the infection, since this form has received less attention than the hæmatogenous infection, which, it is assumed, is the usual source of the infection.

Dr. Bacon remarked that the ætiology of the disease as described was not based upon findings. That I frankly admit to be true; but I would also say with emphasis, that I think the hypothesis is just as true and just as well founded as any of the findings that have been mentioned or reported to demonstrate an ætiology in ureteral compression. To be sure, there are a few cases which would seem to be traced directly to ureteral compression, but they are so few as to be very limited as a causal factor. We are very credulous, and since attention was first attracted to ureteral compression as a causal factor in this disease, we have followed the theory like a band of sheep, without thought or reason as to the origin of the disease in any other source.

The paper was presented with the idea of calling attention to the possibility of another form of infection, or another reason for the presence of infection besides that which is usually accepted, and which I believe to be *wholly false.*

The side position mentioned by Dr. Bacon was also intentionally omitted from the paper, because if we lay aside the theory of utereral compression by the growing uterus, there is no reason for using a side position. To be sure, a woman may accept a side or back position as long as she keeps horizontally in bed, but to put a woman on her side solely to relieve compression of the ureters, which we do not believe exists, would contradict the paper.

With reference to Dr. Schiller's criticism, I would say that it was practically answered by Dr. Kolischer. We find that the kidneys are very susceptible to infection during pregnancy, and the reason that both kidneys are not affected is because one is more resistant than the other. Both must, of course, be equally subjected to the effects of the toxins, but one kidney resists them more than the other, just as one person resists disease more than another, although both are exposed at the same time and to the same influences.

I tried to emphasize the point that the kidneys are probably weakened by the passage of the toxins of pregnancy through them, and that this furnishes a *basis* for the bacterial infection of one or both, but usually one.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF SURGERY

UNDER THE CHARGE OF

JOHN B. MURPHY, M.D. — E. WYLLYS ANDREWS, M.D.
FREDERIC A. BESLEY, M.D. — WM. R. CUBBINS, M.D.

THE FURTHER DEVELOPMENT OF THE OPERATION FOR HIGH CARCINOMATA OF THE RECTUM. By P. Kraske.

Kraske, whose pioneer work did so much to establish the sacral route as a method of extirpating rectal carcinomata, asserts that he is uncompromisingly in favor of the combined method for extirpating carcinomata situated in the upper part of the rectum. He believes that the preliminary laparotomy is of undoubted advantage, not only because it permits the operator to mobilize the rectum completely, but also because it gives a full view of the tumor and its surroundings.

Kraske's technique consists in putting the patient in the full Trendelenburg position, opening the abdomen, passing two silk ligatures above the tumor, and dividing the rectum between these ligatures with the cautery. The upper end of the gut is enveloped in gauze and held by an assistant. Putting traction on the lower ligature aids the operator in completely freeing this part of the bowel, and with it all the regional lymph-nodes. The pelvis is now filled with gauze, and the patient placed in the lateral position. The lower part of the rectum is now exposed by the sacral route, and that part containing the tumor is resected. The upper segment of the rectum is then pulled down into the sacral wound, and sutured to the lower segment by the end-to-end method.

Kraske has operated upon ten patients by the combined method, with a mortality of forty per cent. — *Arch. f. klin. Chir.*, bd. lxxx, h. 3.

M. G. SEELIG.

APPENDICITIS IN SUCKLING INFANTS. By E. Kirmisson and M. Guimbellot.

The authors report a case of appendicitis occurring in an eleven-months-old infant, and terminating fatally, after operative interference had been resorted to. This case is made the basis of a report of twenty-six other instances of appendicitis occurring during the first and second years of life. A study of these twenty-six cases showed that there are two distinct modes of onset of the disease. In one set of cases, the onset was insidious, resembling an enterocolitis, whereas in the other set the attack started with fever, vomiting, and rapid pulse.

Of the twenty-six cases reported, nine occurred during the first year of life, and seventeen during the second year. Nineteen patients died and seven recovered. All of the infants attacked before their second year died. Seven of the one-year infants and twelve of the two-year infants were operated upon. The authors conclude that appendicitis is not as rare during the first two years of life as has been supposed formerly. Those cases with a sudden sharp onset offer a very grave prognosis, and the only cases that have recovered are those that were operated upon in the interval. The greatest obstacle in combating the disease is the difficulty of establishing a diagnosis, owing to the impossibility of questioning the patients. — *Revue de Chir.*, Oct., 1906. M. G. SEELIG.

THE APPENDICITIS QUESTION, WITH ESPECIAL RELATION TO ARMY STATISTICS. By Dr. Karrenstein.

Karrenstein considers praetically every phase of the disease appendicitis as it manifested itself in German soldiers since 1868. Ætiology, symptomatology, course of the disease, and operation findings are all considered, and the *data* classified in charts and tables. The main conclusions drawn by Karrenstein are, that:

1. There is no evidence of a larger proportion of cases of appendicitis now than formerly.
2. The disease is more frequent among soldiers garrisoned in large cities.
3. Mortuary statistics do not show that the disease is increasing in severity.
4. The largest number of cases occur in January, and the next largest number in June-July.
5. The most constant cause of the disease is a stagnation of the fæcal matter, due to narrowing of the appendicular opening into the cæcum.
6. Appendicitis is not an infectious disease, but is a purely local manifestation.

7. Trauma plays practically no role as an ætiological factor.

8. The influenza epidemic of 1890 was the cause of a marked increase in the number of cases of appendicitis during that year.

9. Influenza is a predisposing factor in winter, and gastro-intestinal diseases in summer.

10. It is possible that tonsillar infections may bear some relationship to appendicitis.

11. Appendicitis is rare in old age, and most frequent between the twentieth and thirtieth years. — *Deutsch. Zeit. f. Chir.*, bd. lxxxiv, h. 1–3.

M. G. SEELIG.

SURGERY OF THE HEART. By Professor Wendel.

The author reports a case of stab-wound of the heart (left ventricle), operated upon successfully, about five hours after injury. Wound in the fourth left interspace, about 1½ cm. from sternum. Patient anæmic, restless, very dyspnœic. Radial pulse not palpable. Sounds hardly audible, irregular action. Systole and diastole cannot be distinguished, on account of friction sound. Incision parallel to fourth costal cartilage from sternum to near mamillary line. Resection of fourth costal cartilage. Pleura not opened. Wound in pericardium discharging blood at intervals. Additional incisions vertical to first, at either end. Resection of fifth costal cartilage. Downward reflection of flap. Removal of a piece 1 cm. wide from sternum. Enlargement of wound in pericardium. Heart pulled from sac; this stops hemorrhage. Wound in left ventricle near septum. Heart held by one hand fixed fairly well; introduction of sutures irrespective of systole or diastole. Cervical catgut used; sutures introduced some distance from wound margins. Reposition of heart. Cardiac action improves at once. Radial pulse palpable. Suture of pericardium. Tampon to pericardium. Drainage of external wound. Duration of operation, fifty minutes. Chloroform anæsthesia. Serous pericarditis of two weeks' duration. After twenty days, light swelling of right arm (thrombosis?), with some rise of temperature. Recovery complete after forty-six days. Has returned to his work as farm-hand. Enumeration of operative methods and extensive quotation of literature follows. — *Archiv für klinische Chirurgie*, vol. lxxx, p. 215.

E. C. RIEBEL, M. D.

PAPILLARY PROLIFERATIONS IN THE GALL-BLADDER. By F. Pels-Leusden, Berlin.

Pels-Leusden, after his investigations upon this subject, conducted subsequently to a case of this nature, comes to the following conclusions:

1. Chronic cholelithiasis frequently produces atypical epithelial proliferations within the mucous membrane and papillary proliferations upon its surface.

2. The immediate mechanical initiation of the gall-stones cannot be the sole cause of these epithelial proliferations, as they are also found when the stone is lodged in the common duct.

3. Mechanical initiation is augmented by inflammatory initiation due to bacteria, also by a change in the composition of the bile, as well as its stagnation. This later, as is well known, may lead to proliferation within the bile capillaries in the liver.

4. He has not been able to examine cases of cholecystitis without stone.

5. These epithelial proliferations predispose most markedly to development of carcinoma in the gall-bladder.

6. The danger of carcinoma forms one more indication for removal of the chronically inflamed gall-bladder, even where those conditions are less advanced. — *Archiv für klinische Chirurgie*, vol. lxxx, p. 128.

E. C. RIEBEL, M. D.

URETERAL CYST CURED BY INTRAVESICAL OPERATION THROUGH OPERATING CYSTOSCOPE. By Dr. B. Klose.

The author describes a case of balloon-like distention of the vesical end of the ureter. Patient, woman 31 years old, married, no children. General history negative. Complains of pain in left inguinal region for some years. At times, increased desire to urinate; also burning sensation during urination. Occasionally, violent pains in left renal region, radiating laterally and to inguinal region. During last two years passed some sand and small red stones quite frequently. Organs normal. Ureters not palpable upon bimanual examination. Pressure upon ureter at entrance into bladder very painful. Cystoscopic examination: Elevation about right ureter strongly developed, 2½ cm. long, size of goose-quill. Opening not on top of elevation, but close to its end. Issues urine at regular intervals. On left side, a pear-shaped tumor is visible. Size that of a medium large hazelnut. Surface is smooth, showing characteristics of adjacent mucous membrane. Transparent and deep red in color. Upon its surface is a small depression. Tumor appears to a sac filled with fluid. The wall appears to be thinner in the region of the depression. It changes its form during observation. It suddenly becomes smaller, and a distinct whirl of fluid is visible upon its lower margin. Ureteral opening not visible. Cauterization of cyst-wall at point of depression. Four days later, puncture of the cauterized portion

by ureteral catheter, which passed into renal pelvis without difficulty. No stones found. Pains in inguinal region disappeared likewise; sensations during urination. Cystoscopy four weeks after operation showed the following: Cyst decreased in size. In upper anterior portion, crater-like opening 4–5 mm. in diameter, allowing inspection of lumen of cyst and ureter. Walls of cyst immovable. Left ureteral opening now visible at lower margin of cyst. — *Archiv für klinische Chirurgie*, vol. lxxx, p. 209. E. C. RIEBEL, M. D.

TORSION OF THE CORD. By Dr. W. Driebholz. From the Clinic in Marburg, Professor Küttner, Director.

Dreibholz reports a case from Küttner's clinic, and collects 73 cases from the literature.

As to the ætiology of the condition, the following points are mentioned:

1. A certain degree of "pedicle formation" of the testicle, or lengthening of the mesorchium, which makes abnormally free movement possible.

2. Ectopia. Cases in which the testis has been hindered in its descent through the canal may undergo a torsion as a result of a sudden tension of the abdominal muscles or external trauma. In these cases, torsion takes place either in the canal or at the external ring.

3. Form of the testis. In cases of torsion, the testis is often found to be flattened. In eight cases, also, it has been found that the vas, vessels, and nerves ran separately, and not in a common covering.

4. Separation of testis and epididymis, due to a lengthening of the vasa efferentia.

5. Age. As a rule, between 15 and 25 years.

Pathology. 1. Degree and direction of the torsion vary very much. Torsions of from 180° to 360° have been observed in either direction.

2. Intratesticular hemorrhage and hemorrhage into the epididymis are always found. Hemorrhagic infarct, as a result of shutting off the venous current, is sometimes found. More seldom, an anæmic infarct may be present, when artery and vein are both occluded.

3. Necrosis of the testis occur within 24 hours after the shutting off of the circulation.

4. The testis is usually greatly enlarged, and the cord below the point of torsion much swollen. The color is blue or black.

5. The cavity of the tunica vaginalis is filled with fluid resembling that found in incarcerated hernia.

Clinical Picture. 1. Pain, sudden and severe. Patient is obliged to lie down and hold the leg of the affected side elevated. Pain at first not localized, but felt in the lumbar region or lower abdomen. Is soon localized in the scrotum.

2. Scrotal skin becomes œdematous and of a bluish color.

3. Tumor palpable, hard to outline, dull on percussion.

4. Collapse, almost always. Nausea and vomiting often.

5. Constipation, usually. Meteorismus sometimes.

6. Slight temperature.

Diagnosis. Difficult. In 73 cases, a correct diagnosis only 7 times. Presence of torsion suspected 11 times; usually mistaken for strangulated hernia, tuberculosis, or ruptured varicocele.

Prognosis. As to life, good. As to the preservation of the testis, the prospect is poorer. In most cases, the testis cannot be saved.

Treatment. 1. Occasionally, spontaneous detorsion occurs.

2. Manipulation sometimes succeeds.

3. Operation, at the earliest possible moment.

(*a*) Detorsion and fixation. If ectopia is present, an attempt should be made to bring the testis into its normal place.

(*b*) Hemicastration. Done in 74 per cent of the cases; most of them having come to operation so late that necrosis was found. — *Die Torsion des Samenstranges. Beiträge zur klinischen Chirurgie, Tübingen*, bd. li. W. C. DANFORTH, M.D.

THE QUESTION OF EARLY OPERATING IN CASE OF INTRACRANIAL INJURY. By Charles Phelps, New York City.

1. Epidural hemorrhage demands operation in such cases as do not obviously tend to spontaneous recovery, or in which a fatal issue is so imminent as to permit of no question.

2. Meningeal contusion, when productive of symptoms, either cannot be diagnosticated from an epidural hemorrhage, or is indistinguishable from the diffuse cerebral œdema with which it is always associated.

A recognized intracranial hemorrhage may be expected to be of pial origin when associated with cerebral lesions, and will indicate operation when the cerebral lesion is regarded as of minor importance.

3. Cerebral contusion: (*a*) Limited — no tendency to a fatal termination, and never suggests operation; (*b*) Diffuse — two classes of cases; in one, a vascular disturbance incapable of self-limitation, not markedly involving the integrity of the cerebral cells, but tending to destroy mechanically their function; in the other, a progressive disintegration of cellular structure, an active process due

to chemical changes, which natural forces prove insufficient to restrain. In the first, operation is theoretically indicated; in the second, in view of the origin and nature of the changes, there is no reason to suppose a simple relief of pressure will stay their progress. In neither is it possible to fix the time when operation may so supplement natural forces and simpler remedial measures as to increase the patient's chances of recovery.

4. Mixed cases — cerebral contusion complicated with pial or epidural hemorrhage. Operation should depend upon the estimated relative importance of the lesions; and the correctness of this estimate must depend upon the acumen and experience of the surgeon. — *Annals of Surgery*, Dec., 1906. WM. R. CUBBINS.

TREATMENT OF BONY ANKYLOSIS OF THE ELBOW-JOINT. By Max Hofmann.

Hofmann reviews the methods so far employed to obtain a movable joint after ankylosis:

1. Resection.

2. Arthrolysis (Wolff). Consisting of removal of the bony connections, preventing motion. Wolff thinks that formation of a flail-joint can thus be prevented. Of five cases, three showed good results, and two had recurrence of bony ankylosis. In one case, where the functional results were especially good, the radial half of the sigmoid cavity was covered with cartilage about the size of a five-cent piece. Hofmann showed experimentally that a small residue of cartilage suffices to cover the articular end again completely with cartilage. After-treatment was painful. Wolff did not obtain complete extension in any cases (150°).

3. Kocher. Resection, with dressing in such manner that the raw bone surfaces did not come in contact for two weeks. Surfaces are then covered with a thin layer of connective tissue.

4. Helferich. Interposition of fascia after resection.

5. Föderl. Interposition of celloidin plates or membranes (ovarian cyst, pig's bladder) after resection.

6. Roser. Interposition of gold plate after resection (fistula formation).

7. Hübscher. Interposition of magnesium plates after detailing bony ankylosis between femur and patella. Fourth day, ballooning of knee-joint, due to formation of hydrogen gas.

8. Schaug. Interposition of a pedicle flap from subcutaneous fat on inner side of arm.

Hofmann used a *non-pedicle periosteal flap* taken from the anterior surface of the tibia in a case of bony ankylosis of the elbow-joint following a pyæmia (influenza). Left elbow-joint in extension of 150°; almost complete supination of forearm. X-ray shows ankylosis to be bony, involving the three bones. Patient, a farmer, does not wish right-angle position of elbow, as least suited for his occupation. Operation: Curved incision at outer border of humerus to head of radius. Bony ankylosis between radius and humerus; severed resection of head of radius. Resection of 1.5 cm. of humerus. Detachment of a periosteal flap from left tibia; length 20 cm. Osteoblastic layer turned toward freshly cut bone. Fixation by a few silk sutures. Suture of wound. Dressed in right-angle position. Eight months later, patient can extend arm to 180°; flexion to 80°. Pronation and supination not complete, supposedly due to some disturbance in lower radio-ulnar joint. — *Archiv für klinische Chirurgie*, vol. lxxx, p. 311.

E. C. RIEBEL, M. D.

TRANS-URETERO-URETERAL ANASTOMOSIS. By Norvelle Wallace Sharpe, St. Louis, Missouri.

Dr. Sharpe presents a method of anastomosis of the ureters, so that in case one is injured to such an extent that end-to-end or end-to-side anastomosis could not be performed, it would still be possible to preserve the kidney with a normal outlet, instead of placing the cut end in the rectum or making a cutaneous fistula.

The main point of interest is that the anastomosis is retroperitoneal, anterior or posterior to the abdominal aorta and inferior vena cava.

The anastomosis behind the aorta would surely save stretching the ureter, but the author is in doubt as to whether it would be compressed between the great vessels and the vertebral column sufficiently to cause a hydro-ureter and hydronephrosis. The fact that the stripped ureter would be in the same type of tissues in which it originally was, certainly would be advantageous, because to just what extent a human ureter can be separated from the surrounding tissues and blood-supply, and live, has not been demonstrated sufficiently. — *Annals of Surgery*, Nov., 1906. WM. R. CUBBINS.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF GYNECOLOGY

UNDER THE CHARGE OF

J. Clarence Webster, M.D. E. C. Dudley, M.D.
John C. Hollister, M.D. F. W. Lynch, M.D.

The Relation of the Nerves in the Uterus. By Alfr. Labhardt.

This is a very long and thorough article upon the subject. It covers some seventy-five pages, has several illustrated figures, and references to one hundred and thirty articles from the literature.

The work was done at the Woman's State Hospital at Basel and in the physiological department of the University at Basel.

After referring to the widespread importance of the nervous system in its relation to the uterus, to the efforts that have been made to establish the relations of uterus and menstruation to the ovaries, and to the controversies and questions that have arisen in consideration of the interdependence of the whole female organism and the genital organs, he confines his main remarks in this article to answering the following questions:

1. How do the nerve fibers run in the uterine tissue?

2. How do the fibers end in the myometrium and how in the mucous membrane?

3. Are there ganglion cells in the substance of the uterus?

Before discussing and answering these questions, he contributes the following paragraphs, which deal with the nerve-supply of the uterus from without. He says, after reviewing an enormous mass of literature, that the following may be considered as acceptable to-day:

"The uterus contains sympathetic nerve fibers, as well as those which arise from the cerebrospinal system. The sympathetic fibers run down in the aortic plexus, to which branches are given off from the solar ganglion. In its projection down, besides the aortic plexus, are present, also, auxiliary fibers from the lumbar ganglion of the sympathetic.

"At the point of bifurcation of the aorta, the aortic plexus also divides into the two hypogastric plexuses, which surround the rectum and give branches off to it as well as to the other organs of the true pelvis.

"These hypogastric plexuses contain, in turn, auxiliary branches from the sacral ganglia. Single branches on each side run directly from the hypogastric plexus to the uterus, but other branches — and these make up the majority — run to the cervical ganglion, which, to right and left, lie about in the middle of the height of the neck between the layers of the broad ligament.

"Branches, spinal fibers, enter this ganglion from the third sacral nerves, and also from the second and fourth (at times the two latter together). Most of the fibers which are definitely for the uterus run through the cervical ganglion and have a direct connection with the ganglion cells there.

"There is also another ganglion near the uterine insertion of the true ovarian ligament, made by an anastomosis of the uterine and spermatic nerves.

"Fibers from the cervical ganglion enter the edges of the uterus and follow along them, giving off branches to the substance of the uterus that run toward the median line."

The final tabulated conclusions are as follows:

1. (*a*) An extended nervous system is present in the uterus of rabbits. The thicker trunks run between the two main muscle layers and give off interfascicular branches, which, in turn, give off intrafascicular branches. The large trunks contain, besides numerous (blassen) colorless fibers, a smaller number of fibers containing myelin, which have already lost their medullary layer while within the thicker trunk. (*b*) We also find a rich nervous system in the human uterus. The thicker trunks run within the middle muscular layer, and give off branches here which have an interfascicular position, and from which intrafascicular branches spring. The thicker trunks contain, besides numerous colorless fibers, some of double outline (doppelt conturirte), which have lost their medullary layer while still within the thicker nerve trunk.

2. The method by which the nerve finally ends in the musculature and in the mucous membrane has not been, either in rabbits or in the human specimens, accurately determined by the methods at hand (special golgi and methylene blue).

3. Ganglion cells have not been discovered in the uterus, either in the human specimen or in rabbits.

4. The view that there is an intramural ganglion system is absolutely without foundation. Contraction of the uterus follows: (*a*) Through the nerves, by irritation of the cervical ganglion or by a reflex; (*b*) Through the muscle, by direct irritation of the musculature itself. — *Das Verhalten der Nerven in der Substanz des Uterus. Archiv der Gynäkologie*, bd. lxxx, h. 1. J. C. HOLLISTER.

THE END-RESULTS OF OVARIOTOMY. By Dr. Adolf Glockner.

Glockner's facts have been collected from the University Woman's Hospital at Leipzig. His discussion is limited to answering the question, whether and how far the original pain or complaint caused by the tumor for which the ovariotomy was indicated had been permanently cured by the operation. Proliferating and not retention tumors are here considered.

He has collected five hundred cases from colleagues and from his own work, which have been thoroughly worked up and the end-results known. He follows Pfannenstiel's classification in discussing recurrences under the four headings:

1. Wound recurrence;
2. Lymph-gland recurrence;
3. Metastatic recurrence;
4. Disease of the other ovary left at the operation (die Erkrankung des bei der Operation zurückgelassenen anderen Ovarium).

His anatomical classification is the "useful" one:

1. Connective-tissue tumors;
2. Epithelial tumors;
3. Teratoid tumors.

A. Connective-tissue tumors.

1. Fibroma, 9 cases; 8 remained free from recurrence for from two to twelve years.

2. Sarcoma, 15 cases; recurrences in 53.3 per cent; free from recurrence, 40 per cent (3 to 14 years); questionable, 6.7 per cent.

Seven of the eight recurrences were within the year; one case between the fifth and sixth year.

When, at the same time, the other ovary and uterus were removed, he finds as follows:

Second ovary extirpated, 4 free from recurrence; 8 recurrences.

Second ovary left, 2 free from recurrence; no recurrences.

Total or partial removal of uterus, 2 free from recurrence; 5 recurrences.

B. Epithelial tumors.

1. *Simple serous cystoma* (following Pfannenstiel's definition; not "hydrops folliculi"), 29 cases; 96.6 per cent free from recurrence; 3.4 per cent recurrence. Of the 28 cases, 13 were free for more than 5 years; all but 3, more than 2 years.

2. *Glandular cystoma*, 285 cases; free from recurrence, 269 (or 94.4 per cent); all but 82 over 5 years; 10 recurred (3.5 per cent); 6 questionable (2.1 per cent).

Those that recurred are scattered along from one to eleven years. When a synchronous extirpation of the other ovary was done, 0.9 per cent recurred. When the second ovary was left, 4.6 per cent recurred.

Characteristics of the recurrences (10 cases), 1.4 per cent from cancer; 1.8 per cent from tumor in the other ovary; 0.35 per cent from "pseudomyxoma peritonei." (These ten cases are reviewed in detail.)

Of ten cases of pseudopapillary cystoma, all have remained free of recurrence; five of them for more than six years.

3. *Papillary cystoma*, 19 cases; free from recurrence (one to seventeen years), 17 (89.5 per cent); recurrences (one in first and one in second year), 2 (10.5 per cent).

Both recurrences occurred in cases where the second ovary was extirpated. In both cases, multiple metastases of carcinomatous nature occurred without a distinguishable tumor at the point of origin. Details of these two cases follow.

4. *Carcinoma of the ovary.* (*a*) Primary, 36 cases. Free from recurrence, 13 (36.1 per cent); with recurrence, 22 cases (61.1 per cent); questionable, 1 case (2.8 per cent).

Nine (29 per cent) of those cases free from recurrence have been observed for more than five years. 54.5 per cent of recurrences occurred within the first year and 22.7 per cent within the second year. More than six times as many recurrences occurred in cases where the second ovary was extirpated.

A synchronous total or partial uterine extirpation was done in 53 per cent of those cases free from recurrence, and in 36.3 per cent of those cases in which there was recurrence.

(*b*) Secondary carcinoma of ovary. No definite facts are given under this head.

C. Teratoid Tumors.

1. *Dermoid cysts*, 48 cases; free from recurrence, 46 cases (95.8 per cent); recurrence, 2 (4.2 per cent), both of which occurred in seventh year after operation, and both when second ovary was left.

2. *Teratoma*, 2 cases; free from recurrence (after third year), 1; recurrence (with multiple metastases within a few weeks after operation), 1.

3. *Parovarian cysts*, 39 cases; free from recurrence, 38 (97.4 per cent); recurrence, 1 (2.6 per cent). In the one case the recurrence occurred upon the other side five years and nine months after first operation, but the definite anatomical nature is not known.

The author then says: "Judging from the above findings, it can be said that fibroma of the ovary, serous cystadenoma, and dermoid cystoma are benign tumors." In cases of the latter, he concludes that the second ovary should not be removed at the same time. "The risk of recurrence is very small. Also, the danger of a later carcinomatous degeneration of a dermoid cyst is so small that extirpation is not justifiable on this account. The second ovary should be removed if the climacteric period is near at hand or already present."

"The glandular cystoma is to be considered as a benign tumor, clinically, at any rate, even if its prognosis cannot be considered absolutely favorable." The ten cases of recurrence, six of which were questionable, are considered in detail. The difficulties of recognizing small carcinomatous areas in a large adenomatous tumor, the importance of removing the second ovary in all malignant cases, or in cases where malignancy is suspected, are emphasized. As to the "pseudomyxoma peritonei," the author says that the outcome of this disease is usually an unfavorable one, as a radical operation is very seldom possible. In contrast to Pfannenstiel and Hoffmeier, the author advises the removal of the second ovary when the patient has passed the climacteric period or is near it. He then says, "The progress of the pseudopapillary cystoma is just as favorable as the glandular cystoma," and he is inclined to attribute the result that all his ten cases remained free from recurrence to the fact that in nearly all cases the second ovary was taken out. Arguing from the final results, he emphasizes the importance of distinguishing this form of tumor from the real papillary cystoma, with which it is often confused, because the prognosis of the latter is unfavorable.

Under the subject of papillary cystoma he calls attention to the frequency of double-sided occurrence of these tumors.

Considering the final results in cases of carcinoma of the ovary, he first speaks of the importance in separating the primary and secondary cases, there being no lasting results, of course, in the latter cases.

Of the primary ovarial cancer cases, he has 33.3 per cent free from recurrence after three years; 29 per cent after 5 years.

As compared with recurrences in uterine cancer, the only difference is that in the latter the number of early recurrences is more frequent and the late (after five years) recurrences are rare.

The prognosis of different forms of ovarian cancer he recognizes as being very different, but he cannot from his own cases draw conclusions relative thereto.

"No conclusions can be drawn from our cases relative to the influence of synchronous extirpation of the second ovary as to the permanence of cure in these cases of ovarian carcinoma."

He then quotes Pfannenstiel and Lippert as finding that about fifty per cent of cases were double-sided, and argues for the justification of removing both ovaries, whether visible cancer changes can be distinguished in the second or not.

"This is more true of carcinoma cases even than in papillary cystoma, as one runs the added risk that the metastases already present may become inoperable before the second operation."

"Partial or total extirpation, at the same time, of the uterus unmistakably improves the final result."

Widening this operation to include, also, the removal of draining lymph-channels the author thinks to be, to-day, the only method by which we can hope to improve the permanence of the cure.

"As Pfannenstiel has said, one cannot expect much from attacking the regional lymph-glands for anatomic and technical reasons."

"The number of local recurrences can be lessened to a certain degree by wide removal of neighboring tissue."

"It is hard to judge to-day whether a total or supravaginal amputation is the one of choice."

"Extension of the operative procedure is more important in ovarian cancer."

He calls attention to the difficulties in determining whether the case is one of a primary or secondary ovarian involvement, even at the time of the exploratory laparotomy.

In general, he concludes that the results of ovariotomy are much more favorable than one could hope for even a short time ago.

Of the sarcoma cases he says:

1. Cases can be possibly considered cured after two years, in contrast to carcinoma; and

2. He advises here, also, a synchronous removal of the other ovary, and also uterus, more on theoretical grounds than from consideration of his few cases (in which the second ovary was also sarcomatous in but 12.5 per cent).

As to the teratoma, he speaks of the varying views of different authors relative to their malignancy, and gives as a reason the fact that they do not have an absolute comprehension of what such a tumor is.

Calling the solid tumors, or those nearly so, *teratoma*, and those cystic and containing the well-known "dermoid brei" *dermoids*, has no real reason, except a gross anatomical one. — *Ueber die Enderfolge der Ovariotomie. Archiv für Gynäkologie*, bd. lxxx, h. 1. J. C. HOLLISTER.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF OBSTETRICS

UNDER THE CHARGE OF

C. S. Bacon, M. D. — Rudolph W. Holmes, M. D.
C. v. Bachellé, M. D. — Hugo Ehrenfest, M. D.

Acetonuria in Extrauterine Pregnancy. By Baumgarten and Popper.

The authors found the presence of acetone in the urine a constant symptom in all cases of ectopic pregnancy in which hemorrhages had drained into the peritoneal cavity. In cases in which the clinical history is characteristic of a tubal pregnancy, in which a soft, fluctuating tumor can be found in the posterior cul-de-sac, a persistent absence of a pathologic amount of acetone, in the writers' belief, speaks against the diagnosis of extrauterine pregnancy. This conclusion is drawn from the observation of several patients who later came to operation. The symptom of persistent acetonuria is extremely valuable in the differential diagnosis between cystic tumors of either tube or ovary on the one hand and a hæmatocele on the other, the constant presence of an increased amount of acetone always speaking in favor of the hæmatocele. — *Die Ausscheidung von Acetonkoerpern bei Erkrankungen des weiblichen Genitales. Wiener klin. Wochenschr.*, No. 13, 1906.

Hugo Ehrenfest.

Gangræna Uteri Puerperalis. By K. Schmidlechner.

This disease, usually called "metritis desiccans," is one of the rarest and least known complications of the puerperium. The pathogenesis of the disease is unknown. The process, in the main, consists in a very grave infection of the uterus, in the course of which a portion of the uterine wall becomes necrotic; if death does not occur in the mean time the necrotic parts are finally eliminated through the vagina. Many writers have objected to the misleading term, "metritis desiccans," which defines only the last stage of the disease — in fact, the beginning of the recovery. *Gangræna uteri puerperalis* certainly is a more appropriate name. Three types of the disease can be differentiated; namely, *partialis*, *totalis*, and *perforans*. The diagnosis is comparatively easy if the first symptoms of the disease occur soon after confinement; the diagnosis may become extremely difficult if many weeks have passed since the birth or the expulsion of a small ovum very early in pregnancy. If appearing during the puerperal state, the disease at first does not exhibit any very typical symptoms. There are present the signs of a septic endometritis, with an elevation of temperature; the uterus is large. On the fifth to seventh day an œdema of the external genitalia and perineum may be observed. The lochial secretions gradually increase in amount, and at about the third week consist of a profuse purulent discharge with a fœtid odor. The demarcation and expulsion of the necrotic portion of the uterine wall usually begin in the fourth week. If all the necrotic tissue is eliminated, the amount of the discharge rapidly decreases. The course of this favorable form of gangrene becomes noticeably and characteristically altered if the necrotic process implicates the entire thickness of the uterine wall and perforates into the peritoneal cavity. Of greatest importance in the differential diagnosis is the elimination of a necrotic submucous myoma during the puerperium. The microscopic examination of the eliminated tissue will furnish the clue. The shape and size of the necrotic piece is determined by the extent of the thrombosis in the veins of the corresponding area. Predisposing factors in the production of this gangrene are, tedious labor, severe compression of the tissues for a long time, operative termination of labor, and, in the opinion of some authors, a recent syphilitic infection or diabetes. The prognosis of the disease is bad, the mortality averaging thirty per cent. The possibility of a spontaneous cure is chiefly dependent upon the intensity of the infection, the resistance of the patient against the infection, and the extent of the necrosis. The process may terminate with the formation of intraperitoneal or parametritic abscesses, with perforation into the intestines or with the establishment of a vesical fistula. Later examinations of a few patients who had survived the disease revealed extensive scar formations and contractions. The therapy, first of all, must be a prophylatic one, being identical with the prevention of a

puerperal infection. Intrauterine douches, and, obviously, curettement, which is not mentioned by the writer, incur the grave danger of perforation of the uterus. Gangrene of the uterus is an extremely rare complication of the puerperium. Only forty-eight to fifty cases have been recorded in the literature within the last thirty years. After this clear and complete *exposé* of the disease, the author, Dr. Schmidlechner gives the detailed report of a new case of puerperal gangrene of the uterus. The patient was a v-gravida, 27 years old, who had her last regular menstruation at the end of December. In the middle of February the patient had a severe hemorrhage, followed by fever. She entered the clinic March 1st. The uterus was the size of a fist; from the cervix protruded a necrotic piece of spongy tissue; the anterior wall of the cervix contained a cavity. The diagnosis stood between chorioepithelioma and gangrene. A vaginal hysterectomy was decided upon, and performed on March 3d. Patient made an uninterrupted recovery. The microscopic examination of the specimen demonstrated a necrosis comprising the anterior wall of the cervix and the lower third of the uterus. — *Gangræna uteri puerperalis. Arch. für Gynäk.*, bd. lxxviii, h. 3, p. 525. HUGO EHRENFEST.

RENAL FUNCTION IN "KIDNEY OF PREGNANCY" AND IN ECLAMPSIA. By Otto Büttner.

This interesting paper presents the important results of Büttner's investigations of abnormal renal function in the course of pregnancy. The cryoscopic examination of the urine seemed to offer a means of comparing the activity of the kidneys in eclampsia and in "kidney of pregnancy," with their function in cases of genuine nephritis. Furthermore, a simultaneous investigation of the cryoscopic behavior of the blood of pregnant women seemed to offer an opportunity to determine whether or not Koranyi's theory, that the excretory function of the normal kidney is not limited to the purpose of preserving a constant freezing-point for the blood, also obtains for pregnancy. Büttner comes to the following conclusions: The urine secreted during labor, during the convulsive state of eclampsia, and in cases of "pregnancy-kidney" shows the signs of a relative insufficiency of renal function, and resembles in its cryoscopic aspects most closely the urine of a passive hyperæmic kidney (Stauungsniere). The alterations in the constitution of the urine can be explained by a deficient supply of arterial blood in the kidney. In the convulsive stage of eclampsia this anæmic condition undoubtedly is produced by a spasm of the vessels, and the same cause may obtain for the "kidney of pregnancy" and the "kidney of labor." In a large number of pregnant women this deficient blood-supply leads simply to an abnormal softness or an œdema of the organ, at times to an actual lesion of the epithelium; i. e., to "kidney of pregnancy." The result of this comparative anæmia of the kidneys is a lower molecular concentration of all the fluid constituents of the body; a condition which is not only typical for pregnancy, but also implies certain advantages. Therefore, œdemas appearing during pregnancy, *a priori*, cannot be regarded as symptoms of renal inefficiency, not even in the presence of the characteristic symptoms of "pregnancy-kidney." During pregnancy — contrary to the hypothesis of Koranyi concerning the renal function under normal conditions — the kidney represents the most important means of regulating osmosis; that is, preserving molecular concentration. The insufficient supply of arterial blood in the kidney of the pregnant woman at times produces really serious lesions of the organ, which then result in an absolute insufficiency of its function. The molecular concentration of the blood becomes abnormally high. But this result is without significance in the genesis of eclampsia. Eclamptic convulsions are independent of the presence of substances in the blood which can be excreted through the kidneys; the convulsions, most probably, are due to a spasm of arterial vessels in the brain, and whether the presence of toxins must be necessarily assumed for an explanation of this spasm is a question which, in the author's opinion at least, at the present time cannot be answered in the affirmative. — *Nierenfunction bei Schwangerschaftsniere, Eclampsia, etc. Archiv für Gynäk.*, bd. lxxix, h. 2, p. 421. HUGO EHRENFEST.

BOOK REVIEWS

OBSTETRICS FOR NURSES. By Joseph B. De Lee, M. D., Professor of Obstetrics in the Northwestern University Medical School, Chicago. Second revised edition. 12mo; 510 pp.; fully illustrated. Philadelphia and London: W. B. Saunders Company. 1906. Cloth, $2.50, net.

In this second edition, De Lee follows his usual clear, concise, and direct style in presenting a handy volume, larger by forty-seven pages, bristling with points for physician, student, and nurse. Cæsarean section and pubiotomy are well described; forty new illustrations are added to the text and several of the old ones are redrawn. The book is a distinct addition to the literature of obstetrics, and it is a pleasure to read it.

The author gives the latest and best methods of handling obstetrical complications and technique; and here and there some salient feature enhances its value, because it forces upon us as physicians, as nurses, and as men the ethical, political, and moral problems of our work in a manner that compels attention. Our trained nurses are striving for legislative action, presumably to the exclusion of the so-called "practical" nurse — that *bête noir* of the conscientious accoucheur.

In matters of pure technique the book is full of good suggestions, but it speaks for progress in practices on which authorities differ.

W. E. DODGE.

TEXT-BOOK OF ANATOMY FOR NURSES. By Elizabeth R. Bundy, M. D., Member of the Medical Staff of the Woman's Hospital of Philadelphia; Gynecologist, New Jersey Training-school, Vineland; late Adjunct Professor of Anatomy and Demonstrator of Anatomy in the Woman's Medical College of Pennsylvania; formerly Superintendent of Connecticut Training-school for Nurses, New Haven, etc. With a glossary and 191 illustrations, 34 of which are printed in colors. Philadelphia: P. Blakiston's Son & Co. 1906.

This excellent book was written for nurses in training and graduate nurses. Dr. Bundy says in the preface: "The pupil nurse in a training-school has very few hours at command for the study of text-books, but it is hoped she may find in this *Anatomy for Nurses* an aid to the acquirement of that knowledge of the human body which is so essential to the full understanding of her important duties."

Dr. Bundy has found, in preparing this book, the inevitable difficulty of selection in dealing with a subject of such magnitude in so small a space. Such matters in the book as are not available for immediate use in the hospital, the author trusts, may still be of value to meet the growing need of the graduate nurse as she finds herself developing with the practice of her profession. It is for the graduate nurse, as much as for the pupil nurse, that the work was undertaken.

The old plan of systematic anatomy is followed, but the usual order of subjects is not strictly observed. For example, the description of the blood-vessels is deferred until the student shall have become familiar with many of the organs from which a large number of vessels derive their names.

There is a chapter added, on foods and digestion. While this was not strictly in accord with the original idea of the book, it was added because of its paramount importance to nurses.

The glossary, consisting of about ten pages, appended to the book is quite exhaustive, and is a valuable feature of a work of this kind. The whole make-up of the publication is attractive. The literary style is pleasing, and the book bears the stamp of conscientious and painstaking toil, while many of the descriptions show decided originality of conception.

The work is abundantly illustrated with drawings from many of the well-known authors in anatomy, and altogether the work is one which can be highly recommended to nurses.

THE PHYSICIAN'S VISITING-LIST FOR 1907. This is a convenient sized, leather-bound visiting-list, now in its fifty-sixth year of publication. It contains, besides, the blank leaves for memoranda, calendar, dose-table, revised in accordance with the United States Pharmacopœia of 1900, and other valuable *data*. Philadelphia: P. Blakiston's Son & Co.